Gender Issues in Science/Math Education (GISME): Over 700 Annotated References & 1000 URL's –

Part 1: All References in *Alphabetical Order* * † § ◊

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Abstract

This 12.8 MB compilation of over 700 annotated references and 1000 hot-linked URL's provides a window into the vast literature on *Gender Issues in Science/Math Education* (GISME). The present listing is an update, expansion, and generalization of the earlier 0.23 MB *Gender Issues in Physics/Science Education* (GIPSE) by Mallow & Hake (2002). Included in references on general gender issues in science and math, are sub-topics that include:

(a) Affirmative Action;
(b) Constructivism: Educational and Social;
(c) Drivers of Education Reform and Gender Equity: Economic Competitiveness and Preservation of Life on Planet Earth;
(d) Education and the Brain;
(e) Gender & Spatial Visualization;
(f) Harvard President Summers' Speculation on Innate Gender Differences in Science and Math Ability;
(g) Hollywood Actress Danica McKellar's book *Math Doesn't Suck*;
(h) Interactive Engagement;
(i) International Comparisons;
(j) Introductory Physics *Curriculum S* (for Synthesis);
(k) Is There a Female Science? – Pro & Con;
(l) Schools Shortchange Girls (or is it Boys)?;
(m) Sex Differences in Mathematical Ability: Fact or Artifact?;
(n) Status of Women Faculty at MIT.

In this Part 1 (8.2 MB), ***all*** references are in listed in *alphabetical order* on pages 3-178. In Part 2 (4.6 MB) references related to sub-topics "a" through "n" are listed in *subject order* as indicated above.

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† The reference is Hake, R.R. & J.V. Mallow. 2008. *Gender Issues in Science/Math Education (GISME): Over 700 Annotated Reference & 1000 URL's: Part 1 – All References in Alphabetical Order; Part 2 – Some References in Subject Order*; both online as ref. 55 at < http://www.physics.indiana.edu/~hake/ > and at < http://www.luc.edu/physics/faculty/mallow.shtml >.

◊ This is a continually updated database. Comments and suggestions are welcomed by Richard Hake < rrhake@earthlink.net > and Jeffry Mallow < jmallow@luc.edu >.

§ We thank Linda Schmalbeck, manager of of Sigma Xi's education programs, whose request for information on gender issues in physics education during a 2002 PKAL meeting initiated our literature searches; and Cathy Kessel, president of the "Association for Women in Mathematics" (AWM) for furnishing several valuable math/science education references.

Notes On References

(1) Tiny URL's courtesy < http://tinyurl.com/create.php >.

(2) All URL's were accessed during the period 27 April – 10 July 2008.

(3) The reference formatting takes advantage of the *best* features of the style manuals of the:
(a) American Institute of Physics (AIP), (b) American Psychological Association (APA), and
(c) Council of Science Editors (CSE). This *optimum* formatting is not often employed, but should be.

(4) The notation "online to subscribers at < http://www..... >" often means that non-subscribers can access an abstract and buy the full article at the same URL.

(5) A few education-related references (preceded by asterisks*) are included which are only tangentially related to gender because we think that progress towards gender (and minority) equity in science & math education requires the general reform of K-16 science/math education for *ALL* students.

(6) As indicated in the *Abstract*, included in references to general gender issues in science and math on pp. 3-178 are references to sub-topics. The latter are preceded by superscripts **#XY**:
(a) **A**ffirmative **A**ction: **#AA** ;
(b) **C**onstructivism: **E**ducational and **S**ocial: **#CE** , **#CS** ;
(c) Drivers of Education Reform and Gender Equity: **E**conomic **C**ompetitiveness and Preservation of **L**ife on **P**lanet **E**arth: **#EC** , **#LPE** ;
(d) Education and the Brain: **#EB** ;
(e) Gender & **S**patial **V**isualization: **#SV** ;
(f) Harvard President Summers' Speculation on Innate Gender Differences in Science and Math Ability: **#SSIGD** ;
(g) Hollywood Actress **D**anica **M**cKellar's book *Math Doesn't Suck*: **#DM** ;
(h) **I**nteractive **E**ngagement: **#IE** ;
(i) **I**nternational **C**omparisons: **#IC** ;
(j) **I**ntroductory **P**hysics ***Curriculum S*** (for Synthesis): **#IPCS** ;
(k) Is There a **F**emale **S**cience? – **P**ro & **C**on: **#FSP**, **#FSC** ;
(l) **S**chools **S**hortchange **G**irls (or is it **B**oys): **#SSG** , #**SSB** ;
(m) **S**ex **D**ifferences in **M**athematical **A**bility: Fact or Artifact?: **#SDMA**
(n) Status of Women Faculty at **MIT**: **#MIT**.
Thus, e.g., a search for "**#AA**" (without the quotes) will bring up references related to "Affirmative Action."

(7) As indicated in the *Abstract*, in this Part 1 (8.2 MB) *all* references are listed *in alphabetical order* on pages 3-178. In Part 2 (4.6 MB) references relevant to sub-topics "a" – "n" in "6" above are listed *in subject order*.

(8) ***Why Bother*?**
Alice Rossi (1965), seventy-fourth president of the American Sociological Association, stated: "American society has prided itself on its concern for the fullest development of each individual's creative potential. As a nation, we have become sensitive to the social handicaps of race and class but have remained quite insensitive to those imposed because of sex." Forty-three years later, gender inequity still handicaps the nation's creative and productive potential. In *Beyond Bias and Barriers: Fulfilling the Women in Academic Science and Engineering* [NAP (2007a)], the National Academy's "Committee on Maximizing the Potential of Women in Academic Science and Engineering" states: "The United States economy relies on the productivity, entrepreneurship, and creativity of its people. To maintain its scientific and engineering leadership amid increasing economic and educational globalization, *the United States must aggressively pursue the innovative capacity of all its people—women and men*." [Our *italics*.] Not to mention the vital role women in science and math can play in helping to preserve life on planet Earth! – see Part 2, Section C2.

All* References In Alphabetical Order

AACU. 2002. Association of American Colleges & Universities: "Women" online at < http://www.aacu.org/resources/women/index.cfm >; especially:

INITIATIVES

Campus Women Lead < http://www.aacu.org/campuswomenlead/index.cfm >,
Program on the Status and Education of Women < http://www.aacu.org/psew/index.cfm >,
Women and Scientific Literacy < http://www.aacu.org/womenscilit/index.cfm >,
Moderated Listserv on women in Higher Education < http://list.aacu.org/mailman/listinfo/aacucampuswomenlead >.

PUBLICATIONS

The Courage to Question: Women's Studies and Student Learning < http://tinyurl.com/ysxdt8 > (1992),
Frequently Asked Questions about Feminist Science Studies (1999), < http://www.aacu.org/publications/pdfs/FAQ1.pdf > (180 kB),
Gender, Science and the Undergraduate Curriculum (2001) < http://tinyurl.com/2mswl6 >,
On Campus with Women (tri-quarterly online newsletter) < http://www.aacu.org/ocww/index.cfm >,
PSEW Chilly Climate Series < http://tinyurl.com/2wt277 >,
Students at the Center: Feminist Assessment (1992) < http://tinyurl.com/3g8mrk >,
Warming the Climate for Women in Academic Science (1995) < http://tinyurl.com/29jdbp >,
Women of Color in the Academy Series < http://tinyurl.com/yoqswx >,
Browse All AAC&U Titles < http://tinyurl.com/2xjrjc >.

#AA AAS. 1992. American Astronomical Society, *The Baltimore Charter for Women In Astronomy*, online at < http://www.aas.org/cswa/bc.html >.

#AA AAS. 2005. American Astronomical Society, *The Pasadena Recommendations for Gender Equality in Astronomy*; online at < http://www.aas.org/cswa/pasadenarecs.html > and as a pdf at < http://www.aas.org/cswa/Equity_Now_Pasadena.pdf > (144 kB).

#AA AAS. 2005. American Astronomical Society Sets Goals for Improving Gender Equity in Astronomy; online at < http://www.aas.org/policy/PR/2005/equity.html >.

AAS. 2008. American Astronomical Society, "Committee on Status of Women in Astronomy" (CSWA) online at < http://www.aas.org/cswa/ >. Archives of CSWA's biannual publication *STATUS* are online at < http://www.aas.org/cswa/STATUS.html >.

"*STATUS* consists of original and reprinted articles on topics relating to women in astronomy, in science and/or in society." Full Table of Contents (1996-2007) is at < http://www.aas.org/cswa/STATUS_TOC.html >.

*Part 2 gives references relevant to sub-topics listed *in subject order* as indicated in the *Abstract*.

AAUP. 2006. *Faculty Gender Equity Indicators 2006* ; online at
< http://www.aaup.org/AAUP/pubsres/research/geneq2006 >

". . . . . provides data on four measures of gender equity for faculty at over 1,400 colleges and universities across the country. "The individual campus listings included in the report will serve to promote discussion of faculty gender equity at the local level, where the success of existing strategies to improve the situation of women academics can best be evaluated. In this way, the AAUP hopes to move discussions about the full participation of women as faculty from the realm of abstract goals into concrete actions for improvement."

#SSG AAUW. 1992. *How Schools Shortchange Girls: The AAUW Report*, online at:
< http://www.aauw.org/research/schoolsShortchange.cfm >. An executive summary is online at
< http://www.aauw.org/research/upload/hssg.pdf > (340 kB).

Agreeing with the AAUW report is:

(a) *Failing At Fairness: How Our Schools Cheat Girls* [Sadker & Sadker (1995], and

(b) "Seeing Gender" [Spears (2008)].

Disagreeing with AAUW report is:

(c) "The Myth That Schools Shortchange Girls: Social Science in the Service of Deception" [Kleinfeld (1998)], and

(d) *The War Against Boys: How Misguided Feminism Is Harming Our Young Men* [Sommers (2001)].

#SSG #SSB AAUW. 2001. *Beyond the Gender Wars: A Conversation About Girls, Boys, and Education,* online at < http://www.aauw.org/research/upload/BeyondGenderWar.pdf > (1.2 MB).

#SSG #SSB AAUW. 2008. "*Where the Girls Are: The Facts About Gender Equity in Education*," online at < http://www.aauw.org/research/WhereGirlsAre.cfm >:

Executive Summary at < http://www.aauw.org/research/upload/whereGirlsAre_execSummary.pdf > (2.4 MB)); full report at < http://www.aauw.org/research/upload/whereGirlsAre.pdf > (7.2 MB).

According to the Executive Summary:

[This report] presents a comprehensive look at girls' educational achievement during the past 35 years, paying special attention to the relationship between girls' and boys' progress. Analyses of results from national standardized tests such as the National Assessment of Educational Progress (NAEP) and the SAT and ACT college entrance examinations, as well as other measures of educational achievement, provide an overall picture of trends in gender equity from elementary school to college and beyond. Differences among girls and among boys by race/ethnicity and family income level are evaluated. Together these analyses support three overarching facts about gender equity in schools today:

1. Girls' successes don't come at boys' expense. . . . . .
2. On average, girls' and boys' educational performance has improved. . . . . .
3. Understanding disparities by race/ethnicity and family income level is critical to understanding girls' and boys' achievement.

AAUW. 2008. American Association of University Women, online at < http://www.aauw.org/ > :

National Conference for College Women Student Leaders, 5-7 June 2008, online at < http://www.aauw.org/nccwsl/2008/ >.

National Girls Collaborative Project < http://www.aauw.org/education/ngcp/ >, Opening Opportunities for Girls in Science, Technology, Engineering, and Math (STEM)

Beyond the Gender Wars: A Conversation About Girls, Boys, and Education. AAUW Educational Foundation (2001) < http://www.aauw.org/research/upload/BeyondGenderWar.pdf > (1.2MB).

ACM. 2008. Association for Computing Machinery, Committee on Women in Computing; online at < http://www.acm.org/women/ > :

"ACM-W is the ACM committee on Women in Computing. It celebrates, informs and supports women in computing, and works with the ACM-W community of computer scientists, educators, employers and policy makers to improve working and learning environments for women."

ADA Project. 2008. Online at < http://women.cs.cmu.edu/ada/ > :

"The ADA Project (TAP) is a clearinghouse for information and resources related to women in computing. TAP serves primarily as a collection of links to other online resources, rather than as an archive. TAP includes information on conferences, projects, discussion groups and organizations, fellowships and grants, notable women in Computer Science, and other electronically accessible sites. The goal of TAP is to provide a central location through which these resources can be 'tapped'.

TAP was named after Ada Lovelace and was started in 1994 at Yale University as an online resource for women in computing. Women@SCS < http://women.cs.cmu.edu/ >, an organization at Carnegie Mellon University, maintains TAP on a volunteer basis. We hope that you, the TAP user community, will help us keep TAP as up-to-date as possible. We also welcome your comments and feedback regarding use of the site."

Adams, J.U. 2008. "Focus on Careers: Women in Science—Nurturing Women Scientists," *Science* **319**(5864): 831-836; online at < http://tinyurl.com/39pk3f > :

"It's no longer a pipeline issue, says Nancy Nielsen, president-elect of the American Medical Association. She cites the National Academy of Sciences (NAS) report from last year which showed that although women have earned more than half of the Bachelor's degrees awarded in science and engineering since the year 2000, their representation on university faculties remains woefully low. Indeed, for those with Ph.D.s in engineering and science, four times more men than women hold full-time faculty positions. And minority women with doctorates are less likely than white women, or men of any racial or ethnic group, to be in tenure positions."

#SDMA AEI. 2007. American Enterprise Institute, Event of 1 October on Women and Science (Transcript, Audio, and Video) online at
< http://www.aei.org/events/eventID.1536,filter.all/transcript.asp >. Speaker and panelist biographies are at
< http://www.aei.org/events/contentID.20070927141515154/default.asp >.

***Panel #1*. The Science on Women and Science: What the Data Say**

Moderator: Christina Hoff Sommers, AEI

Panelists:

Rosalind Chaitt Barnett, Brandeis University;
David Geary, University of Missouri;
Richard Haier, University of California–Irvine Medical School;
Elizabeth Spelke, Harvard University.

***Panel #2*. Stereotype Threat: The State of the Research**

Moderator: Christina Hoff Sommers, AEI

Panelists:

Joshua Aronson, New York University;
Amy Wax, University of Pennsylvania Law School.

***Speaker:* Charles Murray, AEI** [our insert - co-author of *The Bell Curve*,
< http://www.aei.org/books/bookID.445/book_detail.asp >]
See also "Academic Inquisitors" [Sommers (2007)].

AEI. 2008. American Enterprise Institute < http://www.aei.org/>:

"American Enterprise Institute for Public Policy Research is a private, nonpartisan, not-for-profit institution dedicated to research and education on issues of government, politics, economics, and social welfare. Founded in 1943, AEI is home to some of America's most accomplished public policy experts--from economics, law, political science, defense and foreign policy studies, ethics, theology, medicine, and other fields. . . .[our insert – see
< http://www.aei.org/scholars/filter.all/scholar_byname.asp >]. . . . The Institute sponsors research and conferences and publishes books, monographs, and periodicals. Its website,
< http://www.aei.org/ >, posts its publications, videos and transcripts of its conferences, biographies of its scholars and fellows, and schedules of upcoming events.

AEI's purposes are to defend the principles and improve the institutions of American freedom and democratic capitalism--limited government, private enterprise, individual liberty and responsibility, vigilant and effective defense and foreign policies, political accountability, and open debate. Its work is addressed to government officials and legislators, teachers and students, business executives, professionals, journalists, and all citizens interested in a serious understanding of government policy, the economy, and important social and political developments."

AERA. 2008. American Educational Research Association, Special Information Group (SIG) "Communication of Research," online at < http://aera-cr.ed.asu.edu/ >.

This group lists *free*, scholarly, peer-reviewed, electronic journals in education throughout the world at < http://aera-cr.asu.edu/ejournals/ >. Especially relevant to the present compilation is *Advancing Women in Leadership Journal* < http://www.advancingwomen.com/awl/awl.html >. In addition, many good education research and development journals are listed.

AIP. 2005. American Institute of Physics, FYI: The AIP Bulletin of Science Policy News, 22 March, "New Report on Women in Physics and Astronomy," online at
< http://www.aip.org/fyi/2005/035.html >.

AIP. 2006. American Institute of Physics, Statistical Research, "Women in Physics" online at < http://www.aip.org/statistics/trends/gendertrends.html >.

AIP. 2008. American Institute of Physics; online at < http://www.aip.org/ > :
Statistical Research Center < http://www.aip.org/statistics/ >
Women in Physics < http://www.aip.org/statistics/trends/gendertrends.html > :
a. Women Physicists Speak Again; survey conducted in connection with the Second IUPAP International Conference of Women in Physics (2005) in Rio de Janeiro, Brazil < http://www.aip.org/statistics/trends/reports/iupap05.pdf > (620 kB)
b. FAQ's about Women in Physics and Astronomy, 2005 < http://www.aip.org/statistics/trends/reports/womenfaq.htm >
c. Women in Physics and Astronomy, 2005. < http://www.aip.org/statistics/trends/reports/women05.pdf > (264 kB)
d. Women Physicists Speak: The 2001 International Study of Women in Physics < http://www.aip.org/statistics/trends/reports/iupap.pdf > (152 kB)

#FSC #CS Almeder, R.F., N. Koertge, & C.L. Pinnick, eds. 2003. *Scrutinizing Feminist Epistemology: An Examination of Gender in Science*. Rutgers University Press; publisher's information at < http://tinyurl.com/4u883j > Amazon.com information at < http://tinyurl.com/29rtf4 > :
Book Description (our *italics*):
This volume presents the first systematic evaluation of a feminist epistemology of science's power to transform both the practice of science and our society. Unlike existing critiques, *this book questions the fundamental feminist suggestion that purging science of alleged male biases will advance the cause of both science and by extension, social justice*.

The book is divided into four sections: the strange status of feminist epistemology, testing feminist claims about scientific practice, philosophical and political critiques of feminist epistemology, and future prospects of feminist epistemology. Each of the essays - most of which are original to this text - directly confronts the very idea that there could be a feminist epistemology or philosophy of science. *Scrutinizing Feminist Epistemology* provides a timely, well-rounded, and much needed examination of the role of gender in scientific research.

Ambrose, S. A., K.L. Dunkle, B.B. Lazarus, I. Nair, & D.A. Harkus, eds. 1999. *Journeys of Women in Science and Engineering: No Universal Constants*. Temple University Press. Amazon.com information at < http://tinyurl.com/2wwwwd >. Note the "Search Inside" feature.

**American Psychologist*. 2008. Online at < http://www.apa.org/journals/amp/ >. Back volumes are listed at < http://psycnet.apa.org/index.cfm?fa=browsePA.volumes&jcode=amp >.

AMS. 2006. Notices of the American Mathematical Society, "Annual Survey of the Mathematical Sciences (AMS-ASA-IMS-MAA), Report On The 2004-2005 New Doctoral Recipients," online at < http://www.ams.org/employment/2005Survey-DG.pdf > (216 kB).

#EB *Anderson, J.R. 2004. *Cognitive Psychology and Its Implications*. Worth, 6th ed., publisher's information at < http://tinyurl.com/6c64a2 > :

"Anderson offers systematic and accessible presentation of the theoretical foundations of higher mental processes, with each important idea made concrete by specific examples and experiments. Focusing on knowledge representation as the central issue of cognition research, the book emphasizes an information processing approach to the field, but *offers thorough coverage of the cognitive neuroscience approach as well (extensively updated for this edition)*. [Our *italics*.] The Sixth Edition also features a new two-color design and an expanded art program, with new figures highlighting areas of the brain most closely associated with specific cognitive functions. The result is a lucid, integrated view of the current state of a dynamic field, from one of its most accomplished practitioners."

Redish (2006) writes: "Take a look at John Anderson's standard text on cognitive science and compare the 4th, 5th, and 6th editions. The 4th has little mention of neuroscience. The 5th has some. The 6th has a picture of the brain on the inside front cover and is filled with neuroscience."

Anita Borg Institute for Women and Technology. 2008. Online at < http://anitaborg.org/ > :

"We are women technologists. We use technology to connect our communities. We create technology because it is who we are — intelligent, creative and driven. We lead with compassion and a belief in inclusion. We develop competitive products and find solutions to problems that impact our lives, our nation, our world. Together, through the Anita Borg Institute for Women and Technology (ABI), we are inventing a better future. Working with men that believe in our mission, we are changing the world for women and technology."

See also < http://en.wikipedia.org/wiki/Anita_Borg >.

Anon. 2008. "Science and sensibility: Myths about mathematics, " in *Women, Science, and Myth* [Rosser (2008)], pp. 109-114.

#CE *Ansbacher, T. 2000. "An interview with John Dewey on science education," *Phys. Teach.* **38**(4): 224-227; online at < http://tinyurl.com/3rdxpc> as a 1.3 MB pdf. A thoughtful and well-researched treatment showing the consonance of Dewey's educational ideas (as quoted straight from Dewey's own writings, not from the accounts of sometimes confused Dewey interpreters) with the thinking of most current science-education researchers. Ansbacher's valuable web site is at < http://web.mac.com/tedans/Science_Services/Welcome.html >. A segment of Ansbacher's simulated interview dealing with educational constructivism is as follows:

Ansbacher: Can you state for us what you see as the guiding principle for the kind of experience-based education you are describing?

Dewey: Education must be conceived as a continuing reconstruction of experience; that the process and the goal of education are one and the same thing. [It does not mean, as it is often misunderstood,] that we have no choice save either to leave the child to his own unguided spontaneity or to inspire direction upon him from without. But [it recognizes] that no such thing as...insertion of truth from without is possible. All depends upon the activity which the mind itself undergoes in responding to what is presented from without.

Ansbacher: *This sounds in line with what today is called the constructivist position*. [Our *italics*.] What role, then, does this leave for the teacher?

Dewey: [The role of] the educator is *to determine the environment of the child*, and thus by indirection to direct. Growth depends upon the presence of difficulty to be overcome by the exercise of intelligence. It is part of the educator's responsibility to see equally to two things: First, that the problem grows out of the conditions of the experience being had in the present, and that it is within the range of the capacity of students; and, secondly, that it is such that it arouses in the learner an active quest for information and for production of new ideas. The new facts and new ideas thus obtained become the ground for further experiences in which new problems are presented. The process is a continuous spiral.

#SDMA APA. 2008. American Psychological Association, "Gender Issues," online at < http://www.psychologymatters.org/gender.html >:

a. "Men and Women: No Big Difference"; online at < http://www.psychologymatters.org/nodifference.html >;

b. "Think Again: Men and Women Share Cognitive Skills: Research debunks myths about cognitive differences"; online at < http://www.psychologymatters.org/thinkagain.html >.

APS. 2007. American Physical Society, "Gender Equity Conference: Strengthening the Physics Enterprise in Universities and National Laboratories," online at < http://www.aps.org/programs/women/workshops/gender-equity/ >. See also "Gender Equity: No Silver Bullet but Lots of Ways to Help" [APS News (2007)].

*APS. 2008a. American Physical Society, Education < http://www.aps.org/programs/education/index.cfm >.

2008b. American Physical Society - CSWP "Committee on Status of Women in Physics," online at < http://www.aps.org/about/governance/committees/cswp/index.cfm > :

"The Committee on the Status of Women in Physics (CSWP) was founded in 1972 to address the encouragement and career development of women physicists. The Committee consists of nine volunteer members appointed by the President of the APS. Throughout its 30-year history, CSWP has been an active sponsor of studies, programs and publications to foster women in physics."

Contains links to annual reports on past activities for 1998-2007.

Gazette News Letter < http://www.aps.org/programs/women/reports/gazette/index.cfm >, issues free online from 1997 to 2008.

APS. 2008c. American Physical Society, WOMEN IN PHYSICS PROGRAMS < http://www.aps.org/programs/women/index.cfm >, with LINKS:

A. In *left-hand* column to:

1. Workshops and Meetings < http://www.aps.org/programs/women/workshops/index.cfm >,
2. Scholarships & Internships < http://www.aps.org/programs/women/scholarships/index.cfm >,
3. Publications & Reports < http://www.aps.org/programs/women/reports/index.cfm >,
4. Speakers Program < http://www.aps.org/programs/women/speakers/index.cfm >,
5. Site Visits < http://www.aps.org/programs/women/sitevisits/index.cfm >,
6. Female Friendly Physics Graduate Programs <http://www.aps.org/programs/women/female-friendly/index.cfm >,
7. Resources < http://www.aps.org/programs/women/resources/index.cfm > :
   a. Gender Equity < http://www.aps.org/programs/women/resources/equity.cfm >,
   b. Studies and Reports < http://www.aps.org/programs/women/resources/studies.cfm >,
   c. Academia < http://www.aps.org/programs/women/resources/academia.cfm >,
   d. Networking, Careers, Mentoring < http://www.aps.org/programs/women/resources/networking.cfm >,
   e. Gender Issues < http://www.aps.org/programs/women/resources/gender.cfm >,
   f. Other Reports < http://www.aps.org/programs/women/resources/other-reports.cfm >,
   g. Postdocs < http://www.aps.org/programs/women/resources/postdocs.cfm >,
   h. Profiles of Women in Science < http://www.aps.org/programs/women/resources/profiles.cfm >,
   i. Associations and Related Links < http://www.aps.org/programs/women/resources/associations.cfm >.

B. In *right-hand* column to:

1. E-mail Lists < http://www.aps.org/programs/women/email-lists/index.cfm >,
2. Blewett Scholarship < http://www.aps.org/programs/women/scholarships/blewett/index.cfm >,
3. Find Female-Friendly Physics Departments < http://www.aps.org/programs/women/female-friendly/index.cfm >,
4. Join Women Speakers List < http://www.aps.org/programs/women/speakers/enroll.cfm >,
5. The Roster of Women & Minorities in Physics < http://www.aps.org/programs/roster/index.cfm >,
6. Contact Education & Diversity Department < http://www.aps.org/about/contact/staff.cfm?office=&initial=&dept=Education+%26+Diversity >.

C. Under "Women in Physics Publications and Reports" to:

1. Physics in Your Future
   < http://www.aps.org/programs/women/reports/physicsfuture/index.cfm >,
2. Best Practices for Recruiting and Retaining Women in Physics
   < http://www.aps.org/programs/women/reports/bestpractices/index.cfm > ,
3. Gazette < http://www.aps.org/programs/women/reports/gazette/index.cfm >.

**APS News* Archives. 2008. Free online to all at
< http://www.aps.org/publications/apsnews/archives/index.cfm >.

APS News. 1996. "Fighting the Gender Gap: Standardized Tests Are Poor Indicators of Ability in Physics" *APS News*, July; online at
< http://www.aps.org/publications/apsnews/199607/gender.cfm > :

"Women and underrepresented minorities typically score significantly lower than men on the standardized tests designed to predict performance in undergraduate and graduate physics and math courses, and are hence more likely to be disqualified during the initial admissions screening process. But according to speakers at a Friday afternoon session at the 1996 Joint APS/AAPT Meeting, standardized tests such as the SAT and GRE are in reality very poor indicators of students' success in these rigorous subject areas. . . . according to Pamela Zappardino, a professional psychologist and executive director of FairTest. . . .[< http://www.fairtest.org/ >]. . . , a Cambridge, Massachusetts organization that focuses solely on assessment reform . . . *'At best, the SAT only accounts for about 16 percent of the in first-year college grades. That isn't a great predictor, by anybody's yardstick*.'. . . An April 1995 study at the University of California, Berkeley, found that women with identical academic indexes to men obtained higher grade point averages in every major on campus, including math and physical sciences." (Our *italics*.)

For criticism of the SAT and GRE see, respectively "Achievement Versus Aptitude in College Admissions" [Atkinson (2001)] and "Views From an Affirmative Activist" [Georgi (2000c)]. Georgi offers extensive anecdotal evidence of the disconnect between physics-research ability and GRE scores, based on his experience as physics-department chair and graduate admissions committee member.

APS News. 2002a. "International Conference Grapples with Issues of Women in Physics" *APS News,* May; online (for APS members) at
< http://www.aps.org/publications/apsnews/200205/iupap.cfm > :

"Concern over the low number of women in physics worldwide was one of the underlying themes at a groundbreaking international conference on women in physics, held 7-9 March in Paris, France, and organized by the International Union of Pure and Applied Physics (IUPAP). More than 300 delegates - about 15% male, and another 15% or more women in their early careers- in 65 national teams gathered to discuss such issues as attracting more girls into physics, balancing family and career, and getting more women into the physics leadership structure."

See also the reports on this conference in *Physics Today* "Women, and Some Men, Ask Why Women Don't Flock to Physics" [Feder (2002)] and in *Science* "Physics: For Women, the Last Frontier," editorial [Tobias *et al*. (2002)].

APS News. 2002b. "Women Physicists Explore Survival Skills at March Meeting," *APS News,* May; online (for APS members) at
< http://www.aps.org/publications/apsnews/200205/survival.cfm > :

"Looking around at a physics conference like the March Meeting, it is not difficult to see that there are not many women attendees. Indeed, it has been no secret that women are severely under-represented in physics. To address this issue, the Committee on the Status of Women in Physics (CSWP), for the first time, hosted a special workshop on the Survival Skills for Successful Women Physicists in conjunction with the March Meeting."

APS News. 2004. "Women Physicists Learn Survival Skills in Montréal," May; online at
< http://www.aps.org/publications/apsnews/200405/survival-skills.cfm > :

"The CSWP first organized such a workshop at the 2002 APS March Meeting, which was very well received. The Montréal workshop was aimed at women physicists seeking advice and training to improve their skills in navigating through the waters of today's research world to advance to the top of their profession. 'A successful career in physics, as in most other fields, requires more than hard work and good technical skills,' said Dongqi Li, a physicist in Argonne National Laboratory's Materials Science Division and co-chair of the workshop, along with APS Executive Officer Judy Franz. Topics discussed included how to negotiate for resources and teaching loads, how to strategically plan one's career, and how to balance the demands of work and family."

APS News. 2006. "Women Who Choose Physics Love It, AIP Survey Discovers," July, online at
< http://www.aps.org/publications/apsnews/200607/women.cfm >.

APS News. 2006. "NAS Study Finds Barriers Remain for Women Physicists," November, online at < http://www.aps.org/publications/apsnews/200611/women.cfm >.

APS News. 2007. "Gender Equity: No Silver Bullet but Lots of Ways to Help," June, online at
< http://www.aps.org/publications/apsnews/200706/genderequity.cfm >.

*Arons, A.B. 1973. "Toward wider public understanding of science," *Am. J. Phys*. **41**(6): 769-782, Oersted medal address; online to subscribers at
< http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=41&Issue=6 >. See also Arons (1974), Hake (2004), and Jossem (2008).

*Arons, A.B. 1974. "Toward wider public understanding of science: Addendum," *Am. J. Phys*. **42**(2): 157-158; online to subscribers at
< http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=42&Issue=2 >.

*Arons, A.B. 1990. *A Guide to Introductory Physics Teaching*. Wiley; reprinted with minor updates in Arons (1997).

*Arons, A.B. 1993. "Guiding Insight and Inquiry in the Introductory Physics Laboratory," *Phys. Teach*. **31**(5): 278-282; online to subscribers at
< http://scitation.aip.org/dbt/dbt.jsp?KEY=PHTEAH&Volume=31&Issue=5 >.

*Arons, A.B. 1997. *Teaching Introductory Physics*. Wiley. Contains a slightly updated version of Arons (1990), plus *Homework and Test Questions for Introductory Physics Teaching* plus a new monograph *Introduction to Classical Conservation Laws*. Amazon.com information at < http://tinyurl.com/3xmfhe >. Note the "Search Inside" feature.

Astin, H.S. 1990. "Educating women: A promise and a vision for the future," *American Journal of Education* **98**(4): 479-493; abstract and first page are online at < http://tinyurl.com/28yxgk >.

Astronomy Program. 2008. Univ. of Alabama, Dept. of Physics and Astronomy, *Four Thousand Years of Women in Science*; online at < http://www.astr.ua.edu/4000WS/ > :

> "4,000 years of women in science, in technology and other altogether creative stuff! Did you know that? Science is a traditional role for women. Dr. Deborah Crocker at the University of Alabama and Dr. Sethanne Howard retired from the US Naval Observatory maintain this site. They are both astronomers. They dedicate this site to all those wonderful women of our past."

*Atkinson, R.C. 2001. "Achievement Versus Aptitude in College Admissions: Students should be selected on the basis of their demonstrated success in learning, not some ill-defined notion of aptitude," *Issues in Science and Technology Online*, Winter: < http://bob.nap.edu/issues/18.2/atkinson.html >. Richard C. Atkinson is president emeritus of the University of California system. He wrote:

> "Fortunately, today we do have an analysis of the SAT's value in admissions decisions. Because our students have been taking the SAT I . . . (an "aptitude" test). . . and the SAT II . . . (an 'achievement' test). . . for more than three decades, UC is perhaps the only university in the country that has a database large enough to compare the predictive power of the SAT I with that of the achievement-based SAT II tests. UC researchers Saul Geiser and Roger Studley have analyzed the records of almost 78,000 freshmen who entered UC over the past four years. They concluded that the SAT II is, in fact, a better predictor of college grades than the SAT I. The UC data show that high school grades plus the SAT II account for about 21 percent of the explained variance in first-year college grades. When the SAT I is added to high school grades and the SAT II, the explained variance increases from 21 percent to 21.1 percent, a trivial increment.
>
> Contrast the above with claims that scores on the SAT aptitude test are positively correlated with:
>
> (a) future educational and career success as set forth in "Sex Differences in Mathematical Ability at Age 13: Their Status 20 Years Later" [Benbow *et al*. (2000)]; and
>
> (b) normalized gains on the "Force Concept Inventory" [Hestenes *et al*. (1992)] as set forth in "Interpreting force concept inventory scores: Normalized gain and SAT scores" [Coletta *et al*. (2007)].

#FSP Auchincloss, P. 1998. "Physics and Feminism," *APS News*, May; online (for APS members) at < http://www.aps.org/publications/apsnews/199805/backpage.cfm >. Auchincloss wrote:

"These feminist studies. . . [our insert - as discussed previously by Auchincloss: Evelyn Fox Keller, Helen Longino, and Donna Haraway]. . . . . of science do not describe a different science . . . [our insert - most contributors to Koertge (1998) would probably disagree] - certainly not a 'feminine science' - but they shift the emphasis so that we see the importance, even necessity, of diversity among scientists. Moreover, they improve on more traditional accounts of science by explaining both its achievements and its lapses. As part of a strategy for increasing the proportion of women in science, feminist studies raise issues of women and science as intellectual questions within the academy, rather than pushing them to the margins of institutional life. And feminist studies undoubtedly challenge our underlying assumptions about the making of men, women, and science. Thus, feminist studies of science may hold a key to the success of efforts to attract and retain women in physics, to create gender equitable environments in physics departments, and to reform physics education. Bringing together physics and feminism - allowing physics to become more feminist - has potential to bring about positive change in the culture of physics and realize a truly diverse physics community."

See the responses by Kilty *et al*. (1998).

AWIS. 2008. Association for Women in Science; online at < http://www.awis.org/ > :

". . . dedicated to achieving equity and full participation for women in science, mathematics, engineering and technology. . . . AWIS has around 3,000 members in fields spanning the life and physical sciences, mathematics, social science, and engineering. Over 50% of AWIS members have doctorates in their respective fields, and hold positions at all levels of industry, academia, and government." See especially:

a. Washington Wire < http://www.awis.org/pubs/wire.html >.

b. *AWIS Magazine* < http://www.awis.org/pubs/mag.html > :

published quarterly and distributed to AWIS members. Published since 1971, each *AWIS Magazine* focuses on issues relevant to women scientists. It contains articles of interest to women scientists, concerning career advancement, the two-spouse problem, academia, working in industry, gaining tenure, overcoming prejudice, and creating a diverse work environment. [Issues in 2006 and after are free online at < http://www.awis.org/pubs/magarchive.html >.]

c. AWIS Books and Reports < http://www.awis.org/pubs/awispub.html >.

d. Recommended Readings < http://www.awis.org/pubs/recreading.html >.

e. Book Reviews < http://www.awis.org/pubs/bookreviews.html >.

AWM. 2008. Association for Women in Mathematics; online at < http://www.awm-math.org/ >. See especially:

A. Newsletter < http://www.awm-math.org/newsletter.html >.

B. Resources < http://www.awm-math.org/resources.html >

1. Education Resources < http://www.awm-math.org/education.html > - Here we've compiled a list of resources for students and their teachers.

2. Career Resources < http://www.awm-math.org/career.html > - Whether you're just considering a career in the mathematical sciences or already fifty years into it, you should find useful information here — including articles and links to more resources for women in math.

3. Biographies of Women in Mathematics < http://www.awm-math.org/biographies.html > - Here we've compiled individual biographies (mostly for AWM's own site) as well as links to other sources for biographies of women in the mathematical sciences and science in general.

4. Online Advertisements < http://www.awm-math.org/ads.html > - Look here for employment and other opportunities.

C. Bibliography < http://www.awm-math.org/bibliography.html >.

D. Mentor Network < http://www.awm-math.org/mentornetwork.html >.

#SDMA AWM. 2005. Association for Women in Mathematics, AWM petition to President Bush and Secretary of Education Spellings: "Concern regarding the inclusion of Dr. Camilla Benbow on the National Mathematics Advisory Panel," online at < http://www.awm-math.org/benbow_petition/benbow_petition.html >. Despite the AWM's petition, Benbow became the vice-chair of the committee – see "National Mathematics Advisory Panel Releases Final Report" [USDE (2008)] and references appended thereto.

See also the AWM petition's background information at < http://www.awm-math.org/benbow_petition/background.html > for a thorough critique of the Benbow & Stanley (1980) research and its sequels on the male-to-female ratios on the SAT (math) test for 12- and 13-year-old students scoring over 700. Among points in the critique are:

(a) The ratio of 13 found by Benbow & Stanley (1983), declined to 4 in 1997 [Stanley (1997)], and to 2.8 in 2005 [Monastersky (2005)]. . . .[our insert – the ratio decline has also been pointed out by Linn (2007) and by Halpern et al. (2007a)].

(b) The ratio decline "is consistent with changes in other measures: 48% of the undergraduate mathematics degrees in the U.S. now go to women, up from 40% in the 1970s [NSF (2004b)]; about one third of the PhDs in mathematics going to U.S. citizens go to women (this percentage has more than doubled since the 1970s) [AMS (2006, p. 236)]; women have even begun to make inroads into the rarified air of the prestigious Putman competition: for decades no woman placed in the top fifteen, but in 2004 there were four women in this exceptional group [Olson (2006)]". . . .[our insert – this suggests that the ratio is strongly influenced by nurture]. . .

(c) The ratio decline has been ignored in publications by Benbow (1988, pp. 172, 182), Lubensky & Benbow (1992), Benbow *et al*. (2000), Pinker (2003), and Geary (1989). . . .[our insert – and in Kimura (2007) and in Benbow's (2008) profile]. . . . . Pinker (2003) references Hedges and Nowell (1995) and Lubinski and Benbow (1992) – see "e" below. Geary is a member of the National Mathematics Advisory Panel [see USDE (2007) and references appended thereto].

(d) "Benbow's (1988) 14-page article in *Behavioral and Brain Sciences* is followed by 34 pages of commentary, mainly from psychologists, that includes critiques of methodology. [In addition,] Eccles and Jacobs (1986) discuss Benbow and Stanley's assumptions about students' formal mathematical experiences in light of empirical studies of SAT performance and course taking. Ruskai (1991) notes also that the Hopkins Center practice of sending students brochures stating that boys outperform girls on the mathematics SAT could bias results."

(e) According to Hemel's (2005b) interview with Lawrence Summers, Summers' speculation on innate gender differences in math/science abilities came from scholars cited in Pinker's (2003) *The Blank Slate: The Modern Denial of Human Nature*. According to reference 20 in the AWM background report, among the scholars cited by Pinker are Lubinski and Benbow (1992) and Hedges and Nowell (1995).

See also "Perceptions and research: Mathematics, gender, and the SAT" [Kessel (2006c)].

#SV Baartmans, B.G. and S.A. Sorby. 1996. "Making Connections: Spatial Skills and Engineering Drawings," *The Mathematics Teacher* **89**(4): 348-357.

Bagenal, F. 2004. "The Leaky Pipeline for Women in Physics and Astronomy," *STATUS*, June, online at < http://www.aas.org/cswa/status/STATUS_Jun04sm.pdf > (940 kB).

Bailey, M.J. 1998. *American Women In Science: 1950 To The Present: A Biographical Dictionary*. ABC-Clio. Amazon.com information at < http://tinyurl.com/3yyh5k >.

*Bain, K. 2004. *What the Best College Teachers Do*. Harvard University Press. Amazon.com information at < http://tinyurl.com/ysouq9>. Note the "Search Inside" feature. For Harvard University Press information see < http://www.hup.harvard.edu/catalog/BAIBES.html >. For an excerpt see < http://www.hup.harvard.edu/pdf/BAIBES_excerpt.pdf > (132 kB). Bain wrote:

"In the early 1980's, two physicists at Arizona State University. . .[our insert- Halloun & Hestenes (1985a,b)]. . . wanted to know whether a typical introductory physics course, with its traditional emphasis on Newton's laws of motion, changed the way students thought about motion. As you read this account, you might substitute for the line 'think about motion' any other phrase that fits your subject. Do the students in any class change the way they think?"

*Ball, D. L. and H. Bass. 2003. "Toward a practice-based theory of mathematical knowledge for teaching," in B. Davis and E. Simmt, eds. *Proceedings of the 2002 Annual Meeting of the Canadian Mathematics Education Study Group*, pp. 3-14. Edmonton, AB: CMESG/GCEDM; "notes for this article" are online at < http://www.citeulike.org/user/ameslondon/article/2131840 >.

*Ball, D. L., J. Ferrini-Mundy, R.J. Kilpatrick, J. Milgram, W. Schmid, & R. Schaar. 2005. "Reaching for common ground in K-12 mathematics education," *Notices of the American Mathematical Society* **52**(9): 1055-58; online at < http://www.maa.org/common-ground/cg-report2005.html >. Regarding instructional methods, Ball *et al.* write (our *italics*):

> "Some have suggested the exclusive use of small groups or discovery learning at the expense of direct instruction in teaching mathematics. *Students can learn effectively via a mixture of direct instruction, structured investigation, and open exploration*. Decisions about what is better taught through direct instruction and what might be better taught by structuring explorations for students should be made on the basis of the particular mathematics, the goals for learning, and the students' present skills and knowledge. For example, mathematical conventions and definitions should not be taught by pure discovery. Correct mathematical understanding and conclusions are the responsibility of the teacher. Making good decisions about the appropriate pedagogy to use depends on teachers having solid knowledge of the subject."

*Ball, D. L. & F.M. Forzani. 2007. "What Makes Education Research 'Educational'? " *Educational Researcher* **36**(9): 529-540; online at < http://tinyurl.com/4y4g2d >. The abstract reads:

> "Education research is plagued by skeptics who doubt its quality and relevance. Inhabitants of schools of education have been among the sharpest critics, and internal battles rage over method and rigor. Yet often lacking is research that explains causes or examines the interplay at the heart of educational practice and policy. This article argues for a conception of research in education that deliberately presses into what is called here the *instructional dynamic*. Using a sample of studies that exemplify this quintessentially educational perspective, the authors unpack key features of research that probes inside education. They discuss how such research complements in essential ways the other kinds of scholarship that examine and inform education." [*Italics* in the original.]

#EB #SDMA Baron-Cohen, S. 2004. *The Essential Difference: Male And Female Brains And The Truth About Autism*. Basic Books. Amazon.com information at < http://tinyurl.com/5fp5ll >. Note the "Search Inside" feature.

> "FROM PUBLISHERS WEEKLY: Should the title fail to express Baron-Cohen's certainty about gender differences, the Cambridge Univ. professor of psychology and psychiatry lays out his controversial thesis on page one: 'The female brain is predominantly hard-wired for empathy. The male brain is predominantly hard-wired for understanding and building systems.' Defending this bold view is a tough but engaging battle, one that's alleviated by Baron-Cohen's disclaimer that his conclusions refer to statistical majorities rather than 'all men' and 'all women,' but exacerbated by his habit of simultaneously skirting and employing gender stereotypes. His copious evidence ranges from the anecdotal to the anthropological, and from the neurological to the case study (the author and his research team conducted many of these studies)."

Baron-Cohen, S. 2006. "Sex Differences In Mind: Keeping Science Distinct From Social Policy," in Ceci & Williams (2006).

#FSP Barr, J., & L.I. Birke. 1998. *Common Science?: Women, Science And Knowledge*. Indiana University Press, publisher's information at < http://www.iupress.indiana.edu/catalog/product_info.php?products_id=20721 >. Amazon.com information at < http://tinyurl.com/25cyp2 >. Note the "Search Inside" feature.

*Barr, R.B. & J. Tagg. 1995. "From Teaching to Learning: A New Paradigm for Undergraduate Education," *Change* **27**(6); 13-25, November/December. Reprinted in D. Dezure, *Learning from Change: Landmarks in Teaching and Learning in Higher Education from Change 1969-1999.* American Association for Higher Education, pp. 198-200; also online at < http://tinyurl.com/8g6r4 >.

Barres, B.A. 2007. "Does gender matter?" *STATUS*, January; online at < http://www.aas.org/cswa/status/Status_Jan07.pdf > (724 kB).

#LPE *Bartlett, A.A. 1998. "Reflections on Sustainability, Population Growth, and the Environment – Revisited," online at < http://www.una-colorado.org/mod/forum/discuss.php?d=83 >. A revised version (January 1998)) of a paper that was first published in *Population & Environment* **16**(1): 5-35, September 1994. Bartlett wrote:

> "When applied to material things, the term 'sustainable growth' is an oxymoron. (One can have sustainable growth of non-material things such as inflation.) Daly (1994). . . .[our insert – a more recent edition is Daly (1996)]. . . . has pointed out that 'sustainable development' may be possible if materials are recycled to the maximum degree possible, and if one does not have growth in the annual material throughput of the economy."

#LPE *Bartlett, A.A. , edited by R.G. Fuller, V.P. Clark, & J.A. Rogers. 2004. *The Essential Exponential! For the Future of Our Planet*. Center for Science, Mathematics, and Computer Education, Univ. of Nebraska - Lincoln < http://scimath.unl.edu/csmce/exp.php > :

> "The greatest shortcoming of the human race is our inability to understand the exponential function."
> A.A. Bartlett

#LPE *Bartlett, A.A. 2004. "Thoughts on Long-Term Energy Supplies: Scientists and the Silent Lie: The world's population continues to grow - shouldn't physicists care?" *Physics Today* **57**(7); 53-55; online at < http://fire.pppl.gov/energy_population_pt_0704.pdf > (336 kB). See also (a) the companion *Physics Today* article by Paul Weisz (2004); (b) the ensuing criticism of the views of Bartlett and Weiss (and counters by those authors) in the Letters section of *Physics Today* **57**(11): 12-20, online to all at < http://scitation.aip.org/journals/doc/PHTOAD-ft/vol_57/iss_11/12_1.shtml >; (c) Bartlett (2006). Bartlett (2004) wrote:

> "The most sacred icon in the 'religion' of the US economic scene is steady growth of the gross national product, enterprises, sales, and profits. Many people believe that such economic growth requires steady population growth. Although physicists address the problems that result from a ballooning population—such as energy shortages, congestion, pollution, and dwindling resources—their solutions are starkly deficient. Often, they fail to recognize that the solutions must involve stopping population growth."

#LPE *Bartlett, A.A. 2006. "*Scientific American* and the Silent Lie," *Phys. Teach.* **44**(9): 623-624; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=PHTEAH&Volume=44&Issue=9 >.

*Bass, H. 2005. "Mathematics, Mathematicians, and Mathematics Education," *Bulletin of the American Mathematical Society* **42**: 417-430; online as a 168 kB pdf at < http://tinyurl.com/6cd9vh >. Bass wrote (*italics* in the original):

> "I choose specifically to focus on the involvement of research mathematicians, in part to dispel two common myths. First, it is a common belief among *mathematicians* that attention to education is a kind of pasturage for mathematicians in scientific decline. . . . [our insert – see Clemens (1989)]. . . My examples include scholars of substantial stature in our profession and in highly productive stages of their mathematical careers. Second, many *educators have questioned* the relevance of contributions made by research mathematicians, whose experience and knowledge is so remote from the concerns and realities of school mathematics education. I will argue that the knowledge, practices, and habits of mind of research mathematicians are not only relevant to school mathematics education, but that this mathematical sensibility and perspective is essential for maintaining the mathematical balance and integrity of the educational process—in curriculum development, teacher education, assessment, etc.

Hyman Bass < http://en.wikipedia.org/wiki/Hyman_Bass > is the Roger Lyndon Collegiate Professor of Mathematics (LSA) and Professor of Mathematics Education at the University of Michigan, and former president of the American Mathematical Society (AMS).

Baxter Magolda, M.B. 1992. *Knowing and reasoning in college: Gender related patterns in students' intellectual development*. Jossey-Bass. Amazon.com information at < http://tinyurl.com/2mznlp >.

Baxter Magolda, M.B. 2000. *Creating Contexts for Learning and Self-Authorship: Constructive-Developmental Pedagogy*. Vanderbilt University Press. Amazon.com information at < http://tinyurl.com/6z4m9l >. Note the "Search Inside" feature. Publisher's information at < http://www.vanderbiltuniversitypress.com/bookdetail.asp?book_id=4121 > :

> "By taking a constructive-developmental approach, Baxter Magolda demonstrates how students' ability to construct knowledge is intertwined with the development of their assumptions about knowledge itself and their role in creating it. She shows how the structure of constructive-developmental teaching hinges on three principles: validating students' ability to know, situating learning in students' experience, and defining learning as teachers and students mutually constructing meaning."

#CE *Baxter Magolda, M.B. 2004. "Evolution of a Constructivist Conceptualization of Epistemological Reflection," *Educational Psychologist* **39**(1): 31-42 (special issue on epistemology), abstract online at < http://www.informaworld.com/smpp/content~content=a784755134~db=all~order=page > :

> "The epistemological reflection model offers a constructivist theory of personal epistemology based on a 16-year longitudinal study. Participants' developmental journeys are intertwined with the researchers' journey to trace the evolution of the model and its implications for research and practice to promote personal epistemology."

*Beichner, R.J & J.M. Saul. 2004. "Introduction to the SCALE-UP (Student-Centered Activities for Large Enrollment Undergraduate Programs) Project," in *Proceedings of the International School of Physics "Enrico Fermi" Course CLVI* in Varenna, Italy, M. Vicentini and E.F. Redish, eds. IOS Press; online at < http://www.ncsu.edu/per/Articles/Varenna_SCALEUP_Paper.pdf > (1MB).

Belenky, M.F., B.M. Clinchy, N.R. Goldberger, J.M. Tarule. 1997. *Women's Ways of Knowing: The development of self, voice, and mind*. Harper Collins Publishers, Tenth edition. Amazon.com information at < http://tinyurl.com/23nd7v >. Note the "Search Inside" feature.

#SDMA Benbow, C.P. & J. Stanley. 1980. "Sex differences in mathematical ability: Fact or artifact?" *Science* **210**: 1262-1264; online at
< http://www.vanderbilt.edu/Peabody/SMPY/ScienceFactOrArtifact pdf > (1.1MB):

Abstract: A substantial sex difference in mathematical reasoning ability (score on the mathematics test of the Scholastic Aptitude Test) in favor of boys was found in a study of 9927 intellectually gifted junior high school students. Our data contradict the hypothesis that differential course-taking accounts for observed sex differences in mathematical ability, but support the hypothesis that these differences are somewhat increased by environmental influences.

According to Benbow & Stanley (1983) there were responses to Benbow & Stanley (1980) by C. Tomizuka & S. Tobias; E. Stage & R. Karplus; S. Chipman; E. Egelman *et al.*; D. Moran; E. Luchins & A. Luchins; A. Kelly; and C. Benbow & J. Stanley; *Science* **212**: 114-121 (1981).

In addition, a search at < http://www.sciencemag.org/search.dtl > for the keywords (anywhere in the article) "Benbow mathematical" (all of these words - without the quotes) for times posted between January 1980 and May 2008 yielded 42 hits. The responses of Stage & Karplus (1981) and Tomizuka & Tobias (1981) may be of special interest to physicists, but the Science search engine failed to turn up the latter. The more recent hits were Linn (2007), Mervis (2006), and Hedges & Newell (1995).

#SDMA Benbow, C.P. & J.C. Stanley. 1981. "Mathematical ability: Is sex a factor?" [A response]. *Science* **212**: 118-121; online to subscribers at < http://tinyurl.com/3e9zl7 >.

SDMA Benbow, C.P. & J.C. Stanley. 1983. "Sex Differences in Mathematical Reasoning Ability: More Facts," *Science* **222**: 1029-1031; online at
< http://www.vanderbilt.edu/Peabody/SMPY/ScienceMoreFacts.pdf > (1.1 MB) :

Abstract: Almost 40,000 selected seventh-grade students form the Middle Atlantic region of the United States took the College Board Scholastic Aptitude Test as part of the Johns Hopkins regional talent search in 1980, 1981, and 1982. A separate nationwide talent search was conducted in which any student under age 13 who was willing to take the test was eligible. The results obtained by both procedures establish that by age 13 a large sex difference in mathematical reasoning ability exists and that it is especially pronounced at the high end of the distribution: *among students who scored ≥ 700, boys outnumbered girls 13 to 1*. Some hypothesized explanations of such differences were not supported by the data. [Our *italics*.]

#SDMA Benbow, C.P. 1988. "Sex Differences in mathematical reasoning ability in intellectually talented preadolescents: Their nature, effects, and possible causes," *Behavioral and Brain Sciences*, **11**:169-232; online at < http://www.vanderbilt.edu/Peabody/SMPY/BBSBenbow.pdf > (33 MB). Benbow's 15-page article, pp. 169-183, is followed by (a) 35 pages of "Open Peer Commentary," pp. 183-217; (b) 9 pages of Benbow's response, pp. 217-225; and (c) 8 pages of References, pp. 225-232. Benbow's abstract is:

"Several hundred thousand intellectually talented 12- to 13-year olds have been tested nationwide over the past 16 years with the mathematics and verbal sections of the Scholastic Aptitude test (SAT). Although no sex differences in verbal ability have been found, there have been consistent sex differences favoring males in mathematical reasoning ability, as measured by the mathematics section of the SAT (SAT-M). These differences are most pronounced at the highest levels of mathematical reasoning, they are stable over time . . . .[our insert – if "differences" means the male-to-female ratios on the SAT (math) test for 12- and 13-year-old students scoring over 700, then the ratios have been "stable" in the sense that they have always been greater than two, but the magnitude has diminished with time from 13 in 1983 to 2.8 in 2005 - see e.g. AMW (2005), Linn (2007), Halpern *et al.* (2007a,b)]. . . . ., and they are observed in other countries as well. The sex difference in mathematical reasoning ability can predict subsequent sex differences in achievement in mathematics and science and is therefore of practical importance. To date a primarily environmental explanation for the difference in ability has not received support from the numerous studies conducted over the many years by the staff of the Study of Mathematically Precocious Youth (SMPY) and others. We have studied some of the classical environmental hypotheses: attitudes towards mathematics, perceived usefulness of mathematics, confidence, expectations/encouragement from parents and others, sex-typing, and differential course taking. In addition, several physiological correlates of extremely high mathematical reasoning ability have been identified (left-handedness, allergies, myopia, and perhaps bilateral representation of cognitive functions and prenatal hormonal exposure). It is therefore proposed that the sex difference in SAT-M scores among intellectually talented students, which may be related to greater male variability, results from both environmental and biological factors.

#SDMA Benbow, C. P. & D. Lubinski. 1993. "Psychological profiles of the mathematically talented: Some sex differences and evidence supporting their biological basis. In *The Origins and Development of High Ability. Ciba Foundation Symposium,* 178 (pp. 44-66). Oxford: John Wiley & Sons.

#SDMA Benbow, C.P., D. Lubinski, D. Shea, & H. Eftekhari-Sanjani. 2000. "Sex Differences in Mathematical Ability at Age 13: Their Status 20 Years Later," *Psychological Scientist* **11** (6): 474-487, p. 474; online at < http://www.vanderbilt.edu/Peabody/SMPY/SexDiffs.pdf > (844 kB):

Abstract: "Reported is the 20-year follow up of 1,975 mathematically gifted adolescents (top 1%) whose assessments at age 12 to 14 revealed robust gender differences in mathematical reasoning ability . . . . .[our insert – more precisely, "gender differences in scores on the mathematical aptitude portion of the SAT]. . . . Both sexes became exceptional achievers and perceived themselves as such; they reported uniformly high levels of degree attainment and satisfaction with both their career direction and overall success. The earlier sex differences in mathematical reasoning ability did predict differential educational and occupational outcomes. The observed differences also appeared to be a function of sex differences in preferences for (a) inorganic versus organic disciplines and (b) a career-focused versus more-balanced life. Because profile differences in abilities and preferences are longitudinally stable, males probably will remain more represented in some disciplines, whereas females are likely to remain more represented in others. These data have policy implications for higher education and the world of work."

#SDMA Benbow, C. P. & D. Lubinski. 2008. "Study of Mathematically Precocious Youth (SMPY)," online at < http://www.vanderbilt.edu/Peabody/SMPY/ > :

"The Study of Mathematically Precocious Youth (SMPY) was founded by Julian C. Stanley, on 1 September 1971, at Johns Hopkins University. Camilla P. Benbow and David Lubinski co-direct SMPY at Peabody College of Vanderbilt University. They are planning to complete a 50-year longitudinal study of five cohorts, consisting of over 5,000 intellectually talented individuals, identified over a 25-year period (1972-1997). The aim of this research is to develop a better understanding of the unique needs of intellectually precocious youth and the determinants of the contrasting developmental trajectories they display over the lifespan. The Study of Mathematically Precocious Youth is a bit of a misnomer, however, because verbally precocious youth have been included for longitudinal tracking, and participants are now all adults. Nevertheless, 'SMPY' has been chosen to be retained to maintain consistency."

#SDMA Benbow, C.P. 2008. Profile at < http://www.indiana.edu/~intell/benbow.shtml >. Benbow wrote:

"The results Dr. Benbow and co-author Julian Stanley reported in 1980 suggested that gender differences in mathematical reasoning ability may have a biological origin, and that the intellectual disparity between males and females in math is only exacerbated by environmental influences, such as differential course-taking and socialization (Benbow & Stanley, 1980). The data, obtained from nearly 10,000 gifted middle school students participating in the longitudinal Study of Mathematically Precocious Youth (SMPY) demonstrated that the large gender differences in mathematical reasoning ability are robust, stable and emerge early in life . . . . [our insert – if "differences" means the measured male-to-female ratios on the SAT (math) test for 12- and 13-year-old students scoring over 700, then the ratios have been "stable" in the sense that they have always been greater than two, but the magnitude has diminished with time from 13 in 1983 to 2.8 in 2005 - see e.g. AWM (2005), Linn (2007), Halpern *et al*. (2007a,b)]. . . . . In the years since the original study, data from the SMPY have continued [to] support this hypothesis (Raymond & Benbow, 1986; Benbow & Lubinski, 1993)."

Benbow, C.P. 2008. Vanderbilt Peabody College information; online at < http://peabody.vanderbilt.edu/x6737.xml >; CV is online at < http://www.vanderbilt.edu/Peabody/SMPY/Benbow-CV2004.pdf > (60 kB).

*Berliner, D.C. and B.J. Biddle. 1996. *The Manufactured Crisis: Myths, Fraud, and the Attack on America's Public Schools*." Addison-Wesley. Amazon.com information at < http://www.amazon.com/Manufactured-Crisis-Attack-Americas-Schools/dp/0201441969 >:

FROM PUBLISHERS WEEKLY – our *italics*: Outrage over perceived scapegoating of educators by legislators and other voluble critics of American public schools fuels the authors' efforts to expose what they consider the real problems. While deploring the campaign of criticism they view as "manufactured," based on misleading data and leading to questionable reforms, they marshal impressive evidence to counter such assertions as that SAT scores have declined and other, similar charges. *The real problems of our schools, they suggest, are societal and economic; they point out, for example, that "family incomes and financial support for schools are much more poorly distributed in our country than in other industrialized nations*. This means that... large numbers of students who are truly disadvantaged attend public schools whose support is far below that permitted in other Western democracies." Berliner, professor of education at the University of Arizona, and Biddle, director for social research at the University of Missouri, identify a wealth of possible strategies for improving schools. A probing, well-argued rebuttal of detractors of public education.

For counter-arguments see Steadman's (1996) review of *The Manufactured Crisis*.

*Berliner, D.C. 2005. "Our Impoverished View of Educational Reform," *Teachers College Record*, August 02, freely online only to subscribers at
< http://www.tcrecord.org/Content.asp?ContentID=12106 >, but the abstract is free to all [Our *italics*.]:

"This analysis is about the role of poverty in school reform. Data from a number of sources are used to make five points. First, that poverty in the US is greater and of longer duration than in other rich nations. Second, that *poverty, particularly among urban minorities, is associated with academic performance that is well below international means on a number of different international assessments. Scores of poor students are also considerably below the scores achieved by white middle class American students*. Third, that poverty restricts the expression of genetic talent at the lower end of the socioeconomic scale. Among the lowest social classes environmental factors, particularly family and neighborhood influences, not genetics, is strongly associated with academic performance. Among middle class students it is genetic factors, not family and neighborhood factors, that most influences academic performance. Fourth, compared to middle-class children, severe medical problems affect impoverished youth. This limits their school achievement as well as their life chances. Data on the negative effect of impoverished neighborhoods on the youth who reside there is also presented. Fifth, and of greatest interest, is that small reductions in family poverty lead to increases in positive school behavior and better academic performance. It is argued that poverty places severe limits on what can be accomplished through school reform efforts, particularly those associated with the federal No Child Left Behind law. *The data presented in this study suggest that the most powerful policy for improving our nations' school achievement is a reduction in family and youth poverty*."

Those concerned with the baleful effects of gender and minority inequity in education might also consider the harmful effects of "poverty inequity."

Beyer, K. 1993. "Gender, Science Anxiety and Learning Style," in *Transforming Science and Technology: Our Future Depends on It,* Proceedings of the 7th International Gender Science and Technology Conference, University of Waterloo, Canada, 1993, pp. 10 – 17 [GASAT#7 (1993)*]

Beyer, K. and J. Reich. 1987. "Why are many girls inhibited from learning scientific concepts in physics?" GASAT#4 (1987)*.

#AA Bhattacharjee,Y. 2007. "Gender Equity: U.S. Agencies Quiz Universities on the Status of Women in Science," *Science* **315** (5820): 1776, summary online at
< http://tinyurl.com/4x5f62 > :

"Officials from the U.S. National Science Foundation, the Department of Energy, and NASA have visited four academic departments on three campuses in the past 14 months to monitor their compliance with a 1972 law that prohibits sex discrimination in educational programs and activities receiving federal funds."

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* **GASAT =** Gender And Science And Technology - see GASAT International (2008). As of 2008 there had been 12 GASAT conferences. Proceedings are evidently available only for GASAT#4 (1987), GASAT#7 (1993), GASAT#8 (1996), & GASAT#11 (2003).

Billard, L. 1991. "The Past, Present, and Future of Academic Women in the Mathematical Sciences," *Notices of the American Mathematical Society* **38**(7): 707-714; online at < http://www.awm-math.org/articles/notices/199107/billard/ >.

BIRS. 2006. Banff International Research Station for Mathematical Innovation and Discovery, *Women Mathematicians in the Academic Ranks: A Call to Action*: Report of the BIRS Workshop On Women in Mathematics, 24-28 September; online at < http://math.uh.edu/~blk/Papers/BIRS-women.pdf > (192 kB).

*Bisgaard, S., L.V. Brillhart, A.B. Burgess, J.H. Cramer, D.D. Denton, J.D. Downer, S.L. Dunwoody, A.B. Ellis, P.W. Hewson, W.G. Secada, & S. Tobias. 1995. "College Level One: Articulation, Equity, and Literacy Issues. The Report of a Workshop Organized by the College Level One Team," at the Univ. of Wisconsin; online as a 9.5 MB pdf at < http://tinyurl.com/49qsja >.

#FSP Bleier, R. 1988. *Feminist Approaches to Science*. Pergamon Press. Amazon.com information at < http://tinyurl.com/347nph >. According to the *Wisconsin Academy Review* **46**(1) [Winter 1999-2000] < http://tinyurl.com/5bo3yk > :

> "Ruth Bleier was a pioneer faculty member who achieved international recognition as a neuroanatomist while 'leading two lives' on the Madison campus. Her second life had a significant influence on the University of Wisconsin-Madison and beyond when she helped develop the Women's Studies Program in 1975. Bleier was a graduate of the Women's Medical College of Pennsylvania. After practicing medicine in Baltimore for eight years, she changed her career, training at Johns Hopkins University to became a neuroanatomist. She joined the faculty of the University of Wisconsin-Madison in 1967 and worked at both the Waisman Center and the Primate Center---leading her to develop an interdisciplinary orientation. While achieving fame for her studies of the mammalian hypothalamus, she also worked throughout her career in the area of political and social bias in science. Bleier's research with the Department of Neurophysiology *led her to recognize gender-related brain structures* [our *italics*], and she became an authority on the organization of the mammalian hypothalamus. After establishing great credibility as a 'hard-core' scientist, she became a revered leader in the field of feminist approaches to the sociology of scientific knowledge."
>
> A list of books by Ruth Bleier is online at < http://isbndb.com/d/person/bleier_ruth.html >.

Boaler, J. 2008. "Promoting 'relational equity' and high mathematics achievement through an innovative mixed ability approach." *British Educational Research Journal* **34**(2): 167-194; online as a 208 kB pdf at < http://tinyurl.com/3qkhs2 >. The abstract reads:

> "Equity is a concept that is often measured in terms of test scores, with educators looking for equal test scores among students of different cultural groups, social classes or sexes. In this paper I propose the term 'relational equity' to describe equitable relations in classrooms; relations that include students treating each other with respect and responsibility. This concept will be illustrated through the results of a 4-year study of different mathematics teaching approaches, conducted in 3 Californian high schools. In one of the schools – a diverse, urban high school – students achieved at higher levels, learned good behavior, and learned to respect students from different cultural groups, social classes, ability levels, and sexes. In addition, differences in attainment between different cultural groups were eliminated in some cases and reduced in all others. Importantly, the goals of high achievement and equity were achieved in tandem through a mixed ability mathematics approach that is not used or well known in the UK."

Boaler, J & M. Staples. 2008. "Creating Mathematical Futures through an Equitable Teaching Approach: The Case of Railside School," *Teachers' College Record* **110**(3): 608-645; online as a 232 kB pdf at < http://tinyurl.com/4lqjl5 >. The abstract reads:

> "The low and inequitable mathematics performance of students in urban American high schools has been identified as a critical issue contributing to societal inequities. In an effort to better the field's understanding of equitable and successful teaching, we report results from a five-year longitudinal study of approximately 700 students as they progressed through three high schools. One of the findings of the study was the important success of 'Railside' school, where the mathematics department had detracked classes some years ago and taught through a reform-oriented approach. At Railside school students learned more, enjoyed mathematics more and progressed to higher mathematics levels. This paper presents large-scale evidence of these important achievements and provides detailed analyses of the ways that the Railside teachers brought them about, with a focus on the teaching and learning interactions within the classrooms."

Boekema, C. 2007. "Undergraduate Research Key to Gender Equity," *APS News*, October, Letters, online at < http://www.aps.org/publications/apsnews/200710/letters.cfm >.

#SSIGD Bombardieri, M. 2005. "Summers displays new understanding of women's careers," *Boston Globe*, 8 April; online at < http://tinyurl.com/728fv >. Bombardieri wrote:

> "Addressing a symposium last night on women in science, Harvard University's president, Lawrence H. Summers, could hardly have sounded more transformed from the man who discussed the same issue in January. Summers's comments last night about the effects of subtle, unconscious bias against women and the impact of encouragement or discouragement on young minds were virtually diametrically opposite from those he made at a National Bureau of Economic Research conference three months ago."

#IC *Bowen, S. 1998. "TIMSS - An Analysis of the International High School Physics Test," *APS Forum on Education Newsletter*, Summer 1998, pp. 7-10, online at < http://www.aps.org/units/fed/newsletters/aug98/timss2.html > : Bowen wrote:

"In conversations with Dr. Senta Raizen of NCISE, who is one of the authors of the data analysis team for the TIMSS project, several important points came up that are not fully emphasized in the study reports. The major characteristic of the U.S. curricula is that they cover a very large number of topics and are primarily focused on vocabulary. Current U.S. students have been exposed to a very large number of topics, but do not have experience in depth on many. The various measures of student interest seem to continually drop with grade level in the U.S. Many other countries exhibit an increase in interest in science around the eighth grade where students go into some depth with various subjects. In the U.S. there is a more or less steady decrease in interest as the number of topics covered continues to increase. . . . . My opinion of the TIMSS message for the physics community is that we need to take responsibility for pre-college physics and science teachers. We need to give them a better training in physics. I think the TIMSS results reflect the same effects as measured by the Force Concept Inventory. . . . .[our insert - Hestenes *et al*. (1992), Hake (1998a,b; 2002a,b)]. . . in introductory mechanics classes. We are not generally giving students an understanding of physics which supports generalization and manipulation of concepts in new contexts."

*Brainard, J. 2007. "The Tough Road to Better Science Teaching: Proponents of new methods encounter resistance, especially at research universities," *Chronicle of Higher Education*, 3 August; Section: Special Report Volume 53, Issue 48, Page A16; online at < http://chronicle.com/free/v53/i48/48a01601.htm >.

See also a version with references, URL's, and inserts added by R.R. Hake, online at the AERA-L archives < http://tinyurl.com/2fxff7 > (scroll to the APPENDIX). [Hake's use of copyrighted material is in accord the "fair use" provision of the section 107 of the US Copyright Law – see e.g., < http://www.law.cornell.edu/uscode/17/107.shtml >.]

#EC *Brakke, D.F. 2006. "Science, Technology and the Global Economy: The 'Augustine' report and others appeal for attention as quickly as possible to expanding the pipeline of students in scientific and technological fields," *AWIS Magazine,* Winter; online at < http://www.awis.org/pubs/magazine/35-1/communicatingScience.pdf > (224 kB). The "Augustine report" is more commonly known as "Rising Above the Gathering Storm" [NAP (2007)]. Brakke wrote:

"A number of recent reports call America to action to address issues related to the nation's scientific and technological enterprise. These reports have come from the Business Roundtable, the National Academies, the Council on Competitiveness, and the Business and Higher Education forum, among others. They focus on the relationship between the scientific and technological developments, creativity, and innovation essential to American competitiveness in the future. This convergence of attention from a wide range of groups coming to very similar conclusions is already leading to bills being introduced in the U.S. Senate and attention by the House Science Committee. Perhaps the most important of the reports, and certainly the most comprehensive, is the one issued by The National Academies, 'Rising Above the Gathering Storm' or sometimes referred to as the 'Augustine Report.' "

Brakke, D.F. 2007. "Outreach in Science, Mathematics, and Engineering," *AWIS Magazine*, Spring, online at < http://www.awis.org/pubs/documents/AWISmagSpring2007.pdf > (2.8 MB).

#EB *Bransford, J.D., A.L. Brown, R.R. Cocking, eds. 2000. *How people learn: brain, mind, experience, and school*. Nat. Acad. Press; online at < http://tinyurl.com/apbgf >. See also *How People Learn: Bridging Research and Practice* [NAP (1999)].

The quote in Hake (2007j) is from page 106 of the earlier edition, i.e., Bransford *et al*. (1999). See also *How People Learn: Bridging Research and Practice* [NAP (1999)].

Britton, E. S. Raizen, J. Kaser, & A. Porter. 2000. "*Beyond Description of the Problems: Directions for Research on Diversity and Equity Issues in K-12 Mathematics and Science Education*," National Institute for Science Education with Western Regional Educational Laboratory, description online at < http://www.wested.org/cs/we/view/rs/502 >.

#SDMA Brody, L.E., L.B. Barnett, & C.J. Mills. 1994. "Gender Differences Among Talented Adolescents: Research Studies by SMPY and CTY at Johns Hopkins," in *Competence and Responsibility: The Third European Conference of the European Council for High Ability*, ed. by K. A. Heller and E. A. Hany. Hogrefe & Huber publishers.

#LPE *Brown, L.R. 2008. *Plan B 3.0, Mobilizing to Save Civilization*. W.W. Norton, 3rd edition. We thank Marc Sabb for calling our attention to this book. Amazon.com information at < http://tinyurl.com/6kgnbo >:

"In this updated edition of the landmark Plan B, Lester Brown outlines a survival strategy for our early twenty-first-century civilization. The world faces many environmental trends of disruption and decline, including rising temperatures and spreading water shortage. In addition to these looming threats, we face the peaking of oil, annual population growth of 70 million, a widening global economic divide, and a growing list of failing states. The scale and complexity of issues facing our fast-forward world have no precedent.

With Plan A, business as usual, we have neglected these issues overly long. In *Plan B 3.0*, Lester R. Brown warns that the only effective response now is a World War II-type mobilization like that in the United States after the attack on Pearl Harbor."

About the Author: Lester R. Brown, president of the Earth Policy Institute. . . . . [< http://www.earth-policy.org/ >]. . . . , is one of the world's most widely published authors, with books in more than forty languages. A MacArthur Fellow, he lives in Washington, DC."

Brown University. 2005. "Achieving Gender Equity in Science Classrooms: A Guide for Faculty," online at < http://www.brown.edu/Student_Services/WiSE/gender.html > :

"The idea for this handbook originated in a Group Independent Study Project (GISP) on gender distinctions in science education at Brown University. The GISP, organized by students concerned about the under-representation of women in science, was designed to examine the role that science education plays in that under-representation. The GISP's goals were to determine the causes of high attrition rates in the undergraduate 'pipeline' in science, math, and engineering for women, and to find solutions to decrease the number of students leaving these fields. The GISP's work included case studies of introductory science classes at Brown, surveys of syllabi and textbooks used in science classrooms, a survey of literature on the history of women in science and current research on gender and science education, and interviews with male and female science faculty."

Brown University. 2008. "Women in Science, Mathematics, and Engineering" online at < http://www.brown.edu/Student_Services/WiSE/ > :

"The Women in Science and Engineering Program (WiSE) at Brown University has a 15-year history of promoting women's study and careers in science, engineering, and mathematics. The program currently serves approximately 600 undergraduate students. More than 50 science faculty participate annually in programs sponsored by WiSE."

Browne, N. ed. 1991. *Science and Technology in the Early Years: An Equal Opportunities Approach*. Open University Press, publisher's information at < http://www.mcgraw-hill.co.uk/openupusa/html/0335211526.html >. Amazon.com information at < http://tinyurl.com/35zv4z >. Note the "Search Inside" feature.

Brownlow, S., T.J Smith, & B.R. Ellis. 2002. "How Interest in Science Negatively Influences Perceptions of Women," *Journal of Science Education and Technology* **11**(2): 135-144; abstract online at < http://www.springerlink.com/content/mctw5lhq1kwcd6xe/ >.

Brownlow, S., T. Jacobi, and M. Rogers. 2000. "Science Anxiety as a Function of Gender and Experience," *Sex Roles* **42**(1-2): 119-131; abstract online at < http://www.springerlink.com/content/h887431l64114wk1/ >.

#EB *Bruer, J.T. 1997. "Education and the Brain: A Bridge Too Far," *Educational Researcher* **26**(8): 4-16, online at < http://www.jsmf.org/about/j/education_and_brain-smaller.pdf> (4.5 MB).

#EB *Bruer, J.T. 2006. "Points of View: On the Implications of Neuroscience Research for Science Teaching and Learning: Are There Any? A Skeptical Theme and Variations: The Primacy of Psychology in the Science of Learning," CBE-Life Sciences Education **5**: 104 -110; online at < http://www.lifescied.org/cgi/reprint/5/2/104 >. See also Bruer (1997).

Brush, S.G. 1991. "Women in Science and Engineering," *American Scientist* **79**: 404-419. For an abstract see #238 at Brush's site < http://www.punsterproductions.com/~sciencehistory/sgbpubs.php >.

Brush, S.G. 1995. "Women, Science, and Universities," *Bulletin of Science, Technology & Society* **15**(4): 205 – 214. For an abstract see #255 at Brush's site < http://www.punsterproductions.com/~sciencehistory/sgbpubs.php >.

#IE *Bruff, D. 2008. "Classroom Response Systems ('Clickers')," Vanderbilt Center for Teaching; online at < http://tinyurl.com/6zhqk5 >; includes an extensive bibliography at < http://tinyurl.com/3xcjkv >.

Buna, D. 2001. "Women in Physics: Trends in Recent Decades," *AWIS Magazine*, Spring; online to subscribers at < http://www.awis.org/pubs/magazine/members/Spring2001.pdf >.

Burbidge, M. 2000. "Glass Ceilings and Ivory Towers" *STATUS,* January; online in pdf form at < http://www.aas.org/cswa/status/status_jan00.pdf > (256 kB):

> "I will close by endorsing Meg Urry's. . . .(1999). . . . list of 'ten things you can do' . . . . Number 9 on this list — 'Listen' — reminds us that the concerns of young women today are not what they were 10 years ago, much less 40 years ago. Women can apply for observing time on any telescopes that are available to their male colleagues, and I believe their applications are considered only on scientific merit. *But fair treatment in the job market, in the committee structure of academic institutions where appointments and promotions are dealt with, is another matter, and this must be addressed by all of us*." (Our *italics*.)

*Burgan, M. 2006. "In Defense of Lecturing," *Change Magazine*, November/December; online at < http://www.carnegiefoundation.org/change/sub.asp?key=98&subkey=2105 >. See also "The Lecture System in Teaching Science" [Morrison (1986)]; "A time for telling" [Schwartz & Bransford (1998)]; "Mary Burgan's Defense of Lecturing" [Hake (2007h)]; and Hogarth's "Scholars at a Lecture"
< http://www.artoftheprint.com/artistpages/hogarth_william_scholarsatalecture.htm >.

*Burnstein, R.A. & L.M. Lederman. 2007. "Wireless Keypads - A New Classroom Technology Using Enhanced Multiple Choice Questions." *Physics Education* **24**(3); online at < http://physics.unipune.ernet.in/~phyed/24.3/24.3_Burnstein.pdf > (96 kB). *Physics Education* < http://physics.unipune.ernet.in/~phyed/ > is a peer reviewed online journal that deals with education in physics at the level of secondary school, undergraduate and postgraduate studies.

Butler, C. 2002. "Reaching for the Stars – Interviews with Women Astronauts: Sally Ride," *AWIS Magazine*, Winter; online to subscribers at
< http://www.awis.org/pubs/magazine/members/Winter2002.pdf >. See also Ride (2002).

Button-Shafer, J. 1990. "Why so few women?" *Am. J. Phys.* **58**(1): 13-14; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=58&Issue=1 >. A valuable response to Romer (1988).

#IC *Bybee, R.W. & E. Sage. 2005. "No Country Left Behind: International comparisons of student achievement tell U.S. educators where they must focus their efforts to create the schools the country needs," *Issues in Science and Technology*, Winter, online at < http://www.issues.org/21.2/bybee.html >.

Rodger Bybee is executive director of the Biological Sciences Curriculum Study < http://www.bscs.org/ > in Colorado Springs, Colorado. Elizabeth Stage is director of the Lawrence Hall of Science < http://www.lhs.berkeley.edu/ > at the University of California, Berkeley. Bybee & Sage give a cogent account of the PISA [Program for International Assessment < http://nces.ed.gov/surveys/pisa/ >] and TIMSS [Trends in International Mathematics and Science Study < http://nces.ed.gov/timss/ >] results as of 2005:

> "Economic Time Bomb: U.S. Teens Are Among Worst at Math," blared the December 7, 2004, *Wall Street Journal* headline over a story about the disheartening results of the latest international assessment of student achievement. The *New York Times* and *Washington Post* also carried major stories, albeit with slightly more temperate headlines. All the stories agreed that the results of the Program for International Assessment (PISA), which tested 15-year-olds from 41 countries, are cause for grave concern. *On the math section, the United States ranked 24th out of 29 member nations of the Organization for Economic Cooperation and Development (OECD), falling below Poland, Hungary, and Spain in the three years since the previous assessment*. (Our *italics*.) For a country that prides itself on its scientific and technological prowess, this seems disastrous. But is the situation as bad as the PISA test results indicates?
>
> The following week, the release of the results of another assessment, the *Trends in International Mathematics and Science Study (TIMSS)*, which evaluates students in the fourth and eighth grades, told a somewhat different story. U.S. student performance had improved in the four years since the previous assessment. Of perhaps even greater significance, the troubling gap in math performance between white and black students had contracted. With the proportion of racial and ethnic minorities in the United States growing steadily, the nation's leaders are concerned that some groups have significantly lower test scores than the white majority. The gap was closing in the 1970s and 1980s, but little progress was seen in the 1990s. . . . [Our insert: For another downside to the TIMMS results see "TIMSS - An Analysis of the International High School Physics Test" (Bowen, 1998)]. . . . . ..
>
> If we are to learn the relevant lessons from TIMSS we must begin by understanding how they differ from one another. TIMSS examines student performance and the background characteristics of students, teachers, and schools. Assessment items, which are developed through a consensus of representatives to the International Association for the Evaluation of Educational Achievement (IEA), are designed to link directly to the curricula of the participating countries. The TIMSS report thus specifies what students are expected to learn and how well they are learning it. . . . . PISA, developed by the OECD, has a different purpose. It measures literacy in reading, mathematics, and science in 15-year-olds. In mathematics, PISA assesses how well young adults can recognize and interpret mathematical problems in their world, translate problems into a mathematical context, and use mathematical knowledge and procedures to solve problems. Scientific literacy reflects students' ability to use scientific knowledge, to recognize scientific questions, and to relate scientific data to claims and conclusions. Students are also expected to communicate solutions effectively. PISA is not directly tied to the school curriculum but was conceived and designed to assess the practical outcomes of education systems. In other words, the PISA assessment aims to determine whether students not only have the knowledge they need but also the ability to use it to solve problems. Tests are administered to 15-year-olds, because that is typically the last year of compulsory schooling in participating countries.

Byers, N. 2005. "Einstein and Women," *APS News*, June; online at
< http://www.aps.org/publications/apsnews/200506/history.cfm >.

Byers, N. & G. Williams. 2006. *Out of the Shadows*. Cambridge University Press, publisher's information at
< http://www.cambridge.org:80/us/catalogue/catalogue.asp?isbn=9780521821971 > :

"Why are there so few prominent female physicists? Traditionally women have faced barriers in higher education, denying them access to higher learning and scientific laboratories. Today many of these barriers have been breached, but the female pioneers who overcame discrimination and became major players in their fields remain largely in the shadows. Their names deserve to be known and the importance of their work, achievements and contributions to science warrant recognition. Out of the Shadows provides an accurate and authoritative description of the women who made original and important contributions to physics in the twentieth century, documenting their major discoveries and putting their work into its historical context. Each chapter concentrates on a different woman, and is written by a physicist with considerable experience in their field. The book is an ideal reference for anyone with an interest in science and social history."

For a review see "Women in STEM Careers" [Reilly (2007b)].

Byers, N. & Colleagues. 2008. "Contributions of 20th Century Women to Physics," online at
< http://cwp.library.ucla.edu/ > :

"An archive presenting and documenting some important and original contributions made before 1976 by 20th century women. . . . . Descriptions of important contributions to science made by 83 women in the 20th century. These are documented by the original papers in which the discoveries were first reported. In addition there are historical essays and other historical documents not easily available elsewhere."

A Guide to the site is at < http://cwp.library.ucla.edu/guide.html >.

Bystydzienski, J.M. & S.R. Bird, eds. 2006. *Removing Barriers: Women in Academic Science, Technology, Engineering, And Mathematic*. Indiana University Press; publisher's information at
< http://www.iupress.indiana.edu/catalog/product_info.php?products_id=22614 > :

"This book reviews current barriers to opportunities for participation in the sciences and discusses how academia can address possible solutions, important for academic deans to consider when hiring new faculty. . . . For women's studies and academic departments interested in diversifying their academic units in STEM areas. An excellent, thought-provoking read. . . . Highly recommended." —*Choice*

Amazon.com information at < http://tinyurl.com/2gzwm5 >. Note the "Search Inside" feature.

[#EB] Cahill, L. 2005. "His Brain, Her Brain: It turns out that male and female brains differ quite a bit in architecture and activity. Research into these variations could lead to sex-specific treatments for disorders such as depression and schizophrenia," *Scientific American*, April; online at < http://www.sciam.com/article.cfm?id=his-brain-her-brain >. Cahill begins:

> "On a gray day in mid-January, Lawrence Summers, the president of Harvard University, suggested that innate differences in the build of the male and female brain might be one factor underlying the relative scarcity of women in science. His remarks reignited a debate that has been smoldering for a century, ever since some scientists sizing up the brains of both sexes began using their main finding - that female brains tend to be smaller - to bolster the view that women are intellectually inferior to men. *To date, no one has uncovered any evidence that anatomical disparities might render women incapable of achieving academic distinction in math, physics or engineering*. [Our *italics*.] And the brains of men and women have been shown to be quite clearly similar in many ways. Nevertheless, over the past decade investigators have documented an astonishing array of structural, chemical and functional variations in the brains of males and females."
>
> Larry Cahill < http://www.faculty.uci.edu/profile.cfm?faculty_id=3276 > is an Associate Professor, Neurobiology and Behavior Group, School of Biological Sciences, at the Univ. of California – Irvine.

[#IE] *Caldwell, J.E. 2007. "Clickers in the Large Classroom: Current Reserarch and Best-Practice Tips," *CBE—Life Sciences Education* **6**(1): 9-20, Spring; online at < http://www.lifescied.org/cgi/reprint/6/1/9.pdf > (532 kB).

[#IC] *Campbell, G. 1997. "Raising Expectations," Review of *Aptitude Revisited: Rethinking Math and Science Education for America's Next Century* [Drew (1996)], *Issues in Science and Technology Online,* Spring; online at < http://www.issues.org/13.3/campbe.htm >. Campbell wrote (our *italics*):

> "American children are learning more mathematics and science than they did 20 years ago. That's the good news. *The bad news is that what they're learning remains far from adequate and far less than their counterparts in virtually all of our competitor nations*. In *Aptitude Revisited: Rethinking Math and Science Education for America's Next Century*, David Drew. . .
> [< http://www.cgu.edu/pages/388.asp >]. . . ., professor of education and executive management at the Claremont Graduate School and director of Claremont's Education Program, plunges into the quagmire of U.S. education, valiantly sorting through the multidimensional problems that have our children locked in a pattern of underachievement and our college students abandoning the study of mathematics, science, and engineering. This slim volume efficiently catalogs the myriad, often contradictory, reform efforts of the past 20 years that have yet to realize their promise and ponders the inevitable impact of our enduring failure to prepare our young people for a technology-driven economy. The somewhat understated solution he proposes actually demands no less than a fundamental shift in our approach to education."

Canada, C., & R. Pringle. 1995. "The role of gender in college classroom interactions: a social context approach." *Sociology of Education* **68**: 161-168. An ERIC abstract is online at < http://tinyurl.com/44lc8f >. We thank Leslie Dickie for this reference.

#IE *Carlton College. 2008. "Interactive Engagement," online at
< http://serc.carleton.edu/introgeo/models/IntEng.html > :

"Interactive Engagement (IE) is achieved by questioning students or challenging them to think or to do something that requires thought. Students interact with each other, with the instructor as a coach or guide, or with guided materials created by the instructor (on paper or computer). A key ingredient is frequent and thoughtful interaction. *Most of the quantitative research in science education regarding the effectiveness of IE in a learning environment comes from the physics community so these results are highlighted here*. The references presented were carefully selected to be of generic interest to science teaching and hence are also quite relevant and useful as guidelines for teaching geoscience." [Our *italics*.]

CAWMSET. 2000. Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development, *Land of Plenty: Diversity As America's Competitive Edge in Science, Engineering and Technology,* July 13, online at
< http://www.nsf.gov/pubs/2000/cawmset0409/cawmset_0409.pdf > (1.4 MB). See also NSF (2005a).

#AA Canizares, C. R. 1999. "Commentary," *STATUS,* June; online at
< http://www.aas.org/cswa/status/status_june99.pdf > (320 kB). Canizares wrote:

"To paraphrase Mark Twain, recent reports of the death of discrimination have been greatly exaggerated. These accounts accompany a pernicious surge in legal and political challenges to affirmative action programs, based in part on the premise that such efforts are no longer needed. It is true that significant progress has been made in swelling the ranks of both women and minorities in some areas where they have been previously underrepresented, from Cabinet offices to Boardrooms to the tenured ranks of research universities. The fact that people bother attacking affirmative action programs is itself a sign that, whatever their shortcomings, they have had effect . . . .Where should we be in terms of the representation of women in astronomy? *I strongly believe the only conceivable answer is that women, and indeed all segments of society, should be represented roughly in proportion to their representation in the population at large*." (Our *italics*.) [Canizares is the Bruno Rossi Professor of Experimental Physics and Director of the Center for Space Research at MIT.]

*CBMS. 2001. Conference Board of the Mathematical Sciences, *The Mathematical Education of Teachers,* in *Issues in Mathematics Education*, vol. 11. American Mathematical Society and Mathematical Association of America; online at
< http://www.cbmsweb.org/MET_Document/steering_committee.htm >. Reviewed by Seaman (2003).

#SDMA Ceci, S.J. & W.M. Williams, eds. 2006. *Why Aren't More Women in Science?: Top Researchers Debate the Evidence*. American Psychological Association (APA), publisher's information, including the Table of Contents, is at < http://books.apa.org/books.cfm?id=4316085 >. For an interview with Wendy Williams regarding this book see Phillips (2008). The APA wrote:

> "Why aren't more women pursuing careers in science, engineering, and math? Is the lack of women in these fields a consequence of societal discouragements, innate differences in ability between the sexes, or differences in aspirations? These questions always spark a host of other questions—and a multiplicity of answers—all of which have important implications for gender equality and for retaining the nation's competitiveness in the technological marketplace.
>
> The most reliable and current knowledge about women's participation in science is presented in this collection of fifteen essays written by top researchers on gender differences in ability. The essayists were chosen to reflect the diversity and complexity of views on the topic, about which knowledge has been accumulating and evolving for decades. The editors provide an introduction that defines the key issues and embeds them in historical context and a conclusion that synthesizes and integrates the disparate views. Written accessibly to appeal to students and non-specialists as well as psychologists and other social scientists, the contributors reframe this key controversy and challenge readers' emotional and political biases through solid empirical science."
>
> For reviews see "Women in STEM Careers" [Reilly (2007b)] and "Women In Science: Can Evidence Inform the Debate?" [Linn (2007)]. See also "Women in Academe, and the Men Who Derail Them" [Williams (2002)].

Ceci, S.J. & W.W. Williams. 2006. "Are We Moving Closer And Closer Apart? Resolving Conflicting Views On Women In Science - Questions for Discussion and Reflection," in Ceci & Williams (2006).

#DM Chayes, L., D. McKellar, and B. Winn. 1998. "Percolation and Gibbs state multiplicity for ferromagnetic Ashkin-Teller models on Z2," *J. Phys.* **A31**: 9055-9063; abstract online at < http://citeseer.ist.psu.edu/chayes98percolation.html > :

> "For a region of the nearest neighbor ferromagnetic Ashkin—Teller spin systems on Z 2 , we characterize the existence of multiple Gibbs states via percolation. In particular, there are multiple Gibbs states if and only if there exists percolation of any of the spin types. (i.e., the magnetized states are characterized by percolation of the dominant species.) This result was previously known only for the Potts models on Z 2."

Chiarelott, L. and C. Czerniak. 1985. "Science anxiety among elementary school students: an equity issue," *J. Educ. Equity and Leadership* **5**: 291-308.

Chiarelott, L. and C. Czerniak. 1987. "Science anxiety: Implications for science curriculum and teaching," *The Clearing House* **60**: 202-205. ERIC abstract at < http://tinyurl.com/2sto3p >.

Chipman, S. F., D.H. Krantz, and R. Silver. 1992. "Mathematics anxiety and science careers among able college women," *Psych. Science* **3**: 292-295.

Chipman, S. F., L.R. Brush, D.M. Wilson, eds. 1985. *Women and Mathematics: Balancing the Equation*. Lawrence Erlbaum. Amazon.com information at < http://tinyurl.com/yo38vc >.

CIRTL. 2008. Center for the Integration of Research, Teaching, and Learning; online at < http://www.cirtl.net/ >. See especially:

"Learning-through-diversity" < http://www.cirtl.net/pillars_LtD.html >;
Reaching All Students: A Resource for Teaching in Science, Technology, Engineering & Mathematics, 2nd edition, online at < http://tinyurl.com/4pe3jv > (1.9 MB).

*Clemens, H. 1989. "Is There a Role for Mathematicians in Math Education?" *Notices of the American Mathematical Society* **36**(5): 542-544. Clemens wrote (our *italics*):

"Why don't mathematicians from universities and industry belong in math education? The first reason is that it is self-destructive. *The quickest way to be relegated to the intellectual dustbin in the mathematics departments of most research universities today is to demonstrate a continuing interest in secondary*. . .[our insert - or even worse, primary or undergraduate]. . . *mathematics education*. Colleagues smile tolerantly to one another in the same way family members do when grandpa dribbles his soup down his shirt. Math education is certainly an acceptable form of retiring as a mathematician, like university administration [unacceptable forms being the stock market, EST. . .[our insert - Erhard Seminar Training?]. . . , or a mid-life love affair. *But you don't do good research and think seriously about education*."

#CE *Cobb, P. 1994. "Where is the mind? Constructivist and sociocultural perspectives on mathematical development," *Educational Researcher* **23**(7): 13–20; online at < http://calteach.ucsc.edu/aboutus/documents/Cobb-construcandsocdevinmath.pdf > (4.4 MB). The abstract reads:

"Currently, considerable debate focuses on whether mind is located in the head or in the individual-in-social-action, and whether development is cognitive self-organization or enculturation into established practices. In this article, I question assumptions that initiate this apparent forced choice between constructivist and sociocultural perspectives. I contend that the two perspectives are complementary. Also, claims that either perspective captures the essence of people and communities should be rejected for pragmatic justifications that consider the contextual relevance and usefulness of a perspective. I argue that the sociocultural perspective informs theories of the conditions for the possibility of learning, whereas theories developed from the constructivist perspective focus on what students learn and the processes by which they do so."

*Cohen, D.K. & D.L. Ball. 2001. "Making Change: Instruction and its improvement," *Phi Delta Kappan*, September; online at < http://www.compassproject.net/sadhana/teaching/readings/CohenBallKappan.pdf > (840 kB).

Cohen & Ball (CB) contrast successful and unsuccessful instructional implementation by two third grade teachers of a problem posed in a "reform math" text book: "I have pennies, nickels, and dimes in my pocket. Suppose that I pull out three coins. How much money might I have?" CB write: "The contrast between the two classes rests in the *instruction*— in what the teacher and students are actually doing together. Many efforts at improvement fail precisely because they do not take account of the dynamics of teaching and learning." [*Italics* in the original.]

*Cohen, J. 1988. *Statistical power analysis for the behavioral sciences*. Second edition. Lawrence Erlbaum. Amazon.com information at < http://tinyurl.com/57akm8 >. Note the "Search Inside" feature.

Cohoon, J.M. & W. Aspray, eds. 2008 (first published in 2007). *Women and Information Technology: Research on Underrepresentation*. MIT Press, publisher's information, including the Table of Contents and sample chapters, is online at < http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=11584 >. For a review see "Girls and Information Technology" [Reilly (2007c)].

Cole, J.R. (1987 – first printing 1979). *Fair science: Women in the scientific community*. New York: Columbia University Press. Amazon,.com information at < http://tinyurl.com/33zmyx >. For a review see White (1982).

Sociologist Jonathan Cole < http://www.columbia.edu/cu/provost/docs/jrcpage.html >, Provost and Dean of Faculties at Columbia University, 1994–2003, has had – along with his brother Stephen - a long interest in the social organization of science.

#CS *Cole, J.R. 1993. "Balancing Acts: Dilemmas of Choice Facing Research Universities," *Daedalus* **122**(4); online at < http://www.columbia.edu/cu/provost/docs/dilemmas.html >. [Reprinted with permission of *Daedalus*, Journal of the American Academy of Arts and Sciences, from the issue entitled "The American Research University," Fall 1993, Vol. 122, No. 4] Cole wrote:

"One of these. . .(dilemmas). . is represented by a significant attack on the prevailing organizational axioms, or presuppositions, on which research universities have been built. A second is represented by a fundamental challenge to what John Searle calls 'the Western Rationalistic Tradition' in his essay in this volume of *Daedalus*. *This attack is leveled against the presuppositions of rationality, of objectivity, of truth, of 'there being a there out there,' among other basic epistemological and metaphysical presuppositions that have guided discourse throughout most of Western history, and certainly since the seventeenth century*. [Our *italics*.] These challenges to the university's organizational principles and to its philosophical presuppositions are interrelated. They involve conflicting views of the basic principles and what is required to prove that one or another organizational principle is right or wrong."

#CS *Cole, J.R. 1996. "The Two Cultures Revisited," *The Bridge* (National Academy of Engineering) **26**(3-4): 16-21; online at < http://www.nae.edu/nae/bridgecom.nsf/weblinks/NAEW-4NHMJT?OpenDocument > :

"The gulf in understanding between scientists and nonscientists may be traceable to an educational system that neglects the historical importance of scientific and technological developments."

See the classic: *The two cultures and the scientific revolution* [Snow (1959)].

*Cole, J.R. & S. Cole. 1973. *Social Stratification in Science*. University of Chicago Press. Amazon.com information at < http://www.amazon.com/Social-Stratification-Science-Jonathan-Cole/dp/0226113396 >.

Cole, J.R. & H. Zuckerman. 1987. "Marriage, Motherhood, and Research Performance in Science," *Scientific American* **255**(2): 119-125.

See also *The Outer Circle: Women in the Scientific Community* [Zuckerman, Cole, & Bruer (1991)].

Cole, J.R. & B. Singer. 1991. "A Theory of Limited Differences: Explaining the Productivity Puzzle in Science" in Zuckerman, Cole, & Bruer (1991).

See also "Deficit vs Difference: Study Finds Gender Disparity Even Among High Achievers In Science" [Finn (1995)].

Cole, S. & R. Fiorentine. 1991. "Discrimination Against Women in Science: The Confusion of Outcome with Process," in Zuckerman, Cole, & Bruer (1991).

#IE *Coletta, V.P., J.A. Phillips, & J.J. Steinert. 2007. "Interpreting force concept inventory scores: Normalized gain and SAT scores," *Phys. Rev. ST Phys. Educ. Res.* **3**, 010106, Issue 1 – June; online at < http://prst-per.aps.org/abstract/PRSTPER/v3/i1/e010106 > :

Abstract: "Preinstruction SAT scores and normalized gains G on the force concept inventory FCI . . . .[our insert – Hestenes *et al*. (1992)]. . . were examined for individual students in interactive engagement IE courses in introductory mechanics at one high school $N = 335$ and one university $N = 292$, and strong, positive correlations were found for both populations $r = 0.57$ and $r = 0.46$, respectively. These correlations are likely due to the importance of cognitive skills and abstract reasoning in learning physics. . . . . In prior research a strong correlation between FCI G and scores on Lawson's Classroom Test of Scientific Reasoning . . . .[our insert - Lawson (1995)]. . . for students from the same two schools was observed. Our results suggest that, when interpreting class average normalized FCI gains and comparing different classes, it is important to take into account the variation of students' cognitive skills, as measured either by the SAT or by Lawson's test. While Lawson's test is not commonly given to students in most introductory mechanics courses, SAT scores provide a readily available alternative means of taking account of students' reasoning abilities. Knowing the students' cognitive level before instruction also allows one to alter instruction or to use an intervention designed to improve students' cognitive level."

*Colwell, R. 1998. AAAS Science Policy Seminar Series, 16 September; online at < http://www.nsf.gov/news/speeches/colwell/rc80916.htm > :

"Furthermore, we cannot expect the task of science and math education to be the sole responsibility of *K* through 12 teachers while scientists and graduate students live only in their universities and laboratories. *There is no group of people who should feel more responsible for science and math education in this nation than our scientists and scientists-to-be*. In fact, I would say that America's continuing leadership will depend more on the caliber of its human resource than on any other resource. It will not be enough to have a top layer of scientific elite, and another of mediocrity below. *And the situation is really worsened by widespread public science illiteracy*." (Our *italics*.)

Rita Colwell < http://www.nsf.gov/od/lpa/forum/colwell/rrcbio.htm > was the director of the National Science Foundation, 1998-2004, and former President of the University of Maryland Biotechnology Institute.

Colwell, R. 2000. Preface to *The Door in the Dream: Conversations With Eminent Women in Science* [Wasserman (2000)]; online at < http://www.nap.edu/catalog/6375.html >, pp. ix-xii:

> "Intelligence is not linked to the Y chromosome; to exclude half the population from scientific inquiry is to deny us, as a nation, an extraordinary amount of ability and intelligence. . . .The cost of excluding any group has simply become too high. Why are women underrepresented in science today? I wish there were a single reason because then the problem could be easily targeted and changed. But the answer is not simple. *In part, it lies in what I call the 'valley of death' in education, when girls grades 4 through 8 are, in subtle and not so subtle ways, discouraged from pursuing science and engineering. Not only is the invitation not extended, but even those with a natural bent toward science are too often directed elsewhere*. Add to this the dearth of role models (at least ones they might have been told about) and a lack of mentors, and it no surprise that these girls pass science by. . . . Now, having achieved success, I look back and realize that I was indeed climbing a steep hill and that someone was constantly rolling boulders into my path. *Our task today is to prevent someone from rolling those same boulders into the path of young women who seek to make their contribution to the world of science*. . . .The stories of many of the women profiled in *The Door in the Dream* parallel my personal trek. All have the mental toughness to passionately pursue interests they love and to persevere in the face of obstacles. Eventually, like myself, they have reaped the rewards of being under deterred and true to themselves." (Our *italics*.)

Colwell, R. 2001. "Science and Policy: New Perspectives For an Era of Angst," keynote address to the Association for Women in Science 30th Anniversary Leadership Conference Washington, D.C., 19 October; online at
< http://www.nsf.gov/news/speeches/colwell/rc011019awisconf.htm > :

> ". . . one of the most tenacious problems that we still confront is that 'all' . . . (of the science and engineering community). . . does not include a very high percentage of women and minorities. . . .Far too many girls and women fail to even cross the threshold into science and engineering. We know that obstacles and cultural conditioning begin to appear very early in life. In a study of young children reported in the book *Athena Unbound*. . . (Etzkowitz *et al*. 2000). . . . a four-year-old boy told researchers that '...only boys should make science.' . . . The National Assessment of Educational Progress shows a gender gap in science proficiency as early as age 9. The gap widens further through ages 13 and to age 17. There has been little change in this trend over two decades. It is interesting that between ages 25 and 34, the typical American female is more educated than her male counterpart. Women now earn more than half of all college degrees, and over half of those are in the life sciences. Well over 40% of math and chemistry bachelor's degrees also go to females. But some developments are deeply disturbing. For example, the percentage of women receiving bachelor's degrees in computer science has been dropping since the mid-1980s. We see a downward trend for both men and women—but it's been more precipitous for women. If we take a closer look at doctorates earned in the United States by women, we see a divergence among the disciplines. Women now earn around 40% of all doctorates.
>
> However, this differs greatly by field. In the life sciences, women earn over 40% of doctorates. *But in the physical sciences and mathematics, women earn fewer than 20%. In engineering, they receive a little over 10% of PhDs*. . . .(See NSF 2002d). . . But, our problem is larger than the institutions of higher learning. In more than 400 job categories in our economy, women are found predominately in only 20 categories. Women comprise less than a quarter of the total science and engineering labor force. The S&E workforce looks very exclusive. This is dangerous for the nation.

We need the talent of every worker in order to compete and prosper. NSF has taken several steps to reverse this trend. We are, in essence, sealing the pipeline from beginning to end. We have programs targeting girls starting in their preschool days. We fund research to develop computer software and games that encourage interactions in science, math, and engineering. *With our new flagship program, ADVANCE. . . . . , we'll award more than 40 million dollars this year to spark system-wide changes that foster a more positive climate for women to pursue academic careers*. NSF support for women researchers has tripled over the past decade to approach 500 million dollars." (Our *italics*.)

#SSB Conlin, M. 2003. "The New Gender Gap: From kindergarten to grad school, boys are becoming the second sex," *Business Week*, May 26; online at < http://www.businessweek.com/print/magazine/content/03_21/b3834001_mz001.htm?mz >.

Conniff, R. 1997. "WARNING: Feminism is Hazardous to Your Health," *Albion Monitor*, 10 May; online at < http://www.albionmonitor.com/9705a/femhazard.html >. Conniff wrote:

The Independent Women's Forum's. . . . [IWF (2008)]. . . . whole mission. . . is to point out just how pervasive and damaging feminist ideology and "the politics of victimhood" really are.

For the last few years, the group's members have been busy attacking everything from affirmative action to the Violence Against Women Act to the notion that women have not achieved pay equity with men. The idea that women are not yet equal is itself "victimology," according to the group's press kit, which proclaims: "Since 1992, the Independent Women's Forum has been taking on the old feminist establishment - and winning."

Through opinion pieces in newspapers and magazines, appearances on pundit shows, and conferences like this one, the members of the IWF are out to spread their conservative views.
Denouncing "junk science" is their latest crusade.. . . [our insert: see e.g., Kleinfeld (1999)]. . . And they repeat the term so often it becomes a deafening drum beat. Articles about the problem of "junk science"—that is, a broad array of scientific research used by public-interest groups and plaintiffs in product-liability suits-have turned up recently in *The New Republic, Scientific American, ABC News*, and, of course, in newspaper columns by members of the Independent Women's Forum.

"What's starting to happen is that this term, 'junk science,' is being thrown around all the time," Finley says. "People are calling scientists who disagree with them purveyors of 'junk.' But what we're really talking about is a very normal process of scientific disagreement and give-and-take. Calling someone a 'junk scientist' is just a way of shutting them up."

"It's a pejorative term mainly used by industry and its friends to try to trivialize evidence about the risks of medical devices, drugs, and other consumer products," says Sidney Wolfe, director of Public Citizen's Health Research Group. Wolfe has been denounced as a "junk scientist" for promoting the idea that women have been harmed by breast implants. "But the public is right to be concerned about products that have caused harm, or haven't been adequately tested," he says.

By promoting the idea of "junk science," the Independent Women's Forum is doing just what its members accuse the much-maligned "feminist establishment" of doing—trying to silence disagreement and promote an ideological agenda that could warp science and public policy.

But, of course, to accuse them of that would only be the typical, paranoid feminist response.

#EB *Craver, C.F. 2007. *Explaining the Brain*. Oxford University Press, publisher's information at < http://tinyurl.com/58h2kk > :

"What distinguishes good explanations in neuroscience from bad? Carl F. Craver constructs and defends standards for evaluating neuroscientific explanations that are grounded in a systematic view of what neuroscientific explanations are: descriptions of multilevel mechanisms. In developing this approach, he draws on a wide range of examples in the history of neuroscience (e.g. Hodgkin and Huxleys model of the action potential and LTP as a putative explanation for different kinds of memory), as well as recent philosophical work on the nature of scientific explanation. Readers in neuroscience, psychology, the philosophy of mind, and the philosophy of science will find much to provoke and stimulate them in this book."

#FSP Creager, A., E. Lunbeck, & L. Schiebinger, eds. 2001. *Feminism in Twentieth-Century Science, Technology, and Medicine*. University of Chicago Press, publisher's information at < http://www.press.uchicago.edu/cgi-bin/hfs.cgi/00/14325.ctl > :

"The essays in this volume explore how feminist theory has had a direct impact on research in the biological and social sciences, in medicine, and in technology, often providing the impetus for fundamentally changing the theoretical underpinnings and practices of such research."

Cross, K.P. & M.H. Steadman, 1996. *Classroom Research: Implementing the Scholarship of Teaching*. Jossey-Bass. Amazon.com information at < http://tinyurl.com/3bgmxb >. Note the "Search Inside" feature. *See the index sections on "gender differences."*

#CE #CS *Curren, R., ed. 2007. *Philosophy of Education: An Anthology*. Blackwell. Amazon.com information at < http://tinyurl.com/2psk2q >. Note the "Search Inside" feature. Contains four chapters on "Inquiry, Understanding, and Constructivism," including a reprint of Phillips (1995). A marginally useful Google book preview" is online at < http://tinyurl.com/25cgbp >.

Curtin, J.M.. G. Blake, & C. Cassagnau. 1997. "The Climate for Women Graduate Students in Physics," *Journal of Women and Minorities in Science and Engineering* **3**(1&2).

Czujko, R. & R. Ivie. 2005. "Frequently Asked Questions: Women in Physics and Astronomy, 2005," online at < http://www.aip.org/statistics/trends/reports/womenfaq.htm >.

#LPE *Daly. H.E. 1996. *Beyond Growth: The Economics of Sustainable Development*. Beacon Press, publishers information at < http://www.beacon.org/productdetails.cfm?PC=1384 >. A Google "book preview" is online at < http://tinyurl.com/3nfs4v >.

*Dancy, M.H. & R.J. Beichner. 2002. "But Are They Leaning? Getting Started in Classroom Evaluation," *Cell Biology Education* **1**(3): 87-94; online at < http://www.lifescied.org/cgi/content/full/1/3/87 > .

#SDMA Davies, A.P.C. & T.K. Shackelford. 2006. "An Evolutionary Psychological Perspective on Gender Similarities and Differences," *American Psychologist* **61**(6): 640-641, response to Hyde (2005); online as a 40 kB pdf at < http://tinyurl.com/6or89u > . At the same URL is the response "Judgments of Similarity Are Psychological: The Importance of Importance" by G. E. Zuriff and the Hyde's "Gender Similarities Still Rule," a reply to the responses.

Davis, C.S., A.B. Ginorio, C.S. Hollenshead, B.B. Lazarus, P.M. Raymond, & Associates, eds. 1996. *The Equity Equation: Fostering the Advancement of Women in the Sciences, Mathematics and Engineering*. Jossey-Bass. Amazon.com information at < http://tinyurl.com/37ehxm >. For a list of contributions see
< http://www.goenc.com/records/record_generator.asp?encnum=017148 >.

Book Description: "The Equity Equation deals candidly, thoroughly, and objectively with issues for women in science, engineering, and mathematics. This much-needed study not only investigates the institutional causes of gender inequity, but lays out the research, policy, and programs needed to change the status quo." James Duderstadt.

Duderstadt is president emeritus of the University of Michigan and former member of the National Science Board. See his insightful *A University for the 21st Century* [Duderstadt (2000)].

#IE *DeHaan, R.L. 2005. "The Impending Revolution in Undergraduate Science Education," *Journal of Science Education and Technology* **14**(2): 253-269; abstract online at
< http://tinyurl.com/ymwwe3 >.

ABSTRACT**:** **"**There is substantial evidence that scientific teaching in the sciences, i.e. teaching that employs instructional strategies that encourage undergraduates to become actively engaged in their own learning, can produce levels of understanding, retention and transfer of knowledge that are greater than those resulting from traditional lecture/lab classes. But widespread acceptance by university faculty of new pedagogies and curricular materials still lies in the future. In this essay we review recent literature that sheds light on the following questions:

a. What has evidence from education research and the cognitive sciences told us about undergraduate instruction and student learning in the sciences?
b. What role can undergraduate student research play in a science curriculum?
c. What benefits does information technology have to offer?
d. What changes are needed in institutions of higher learning to improve science teaching?

We conclude that widespread promotion and adoption of the elements of scientific teaching by university science departments could have profound effects in promoting a scientifically literate society and a reinvigorated research enterprise. [Our *italics*.]

#IC *DeHaan, R.L. & M. Hutcheson. 2007. "Teaching Innovation: Implications for India, China and America," *China Currents* **6**(2); online at
< http://www.chinacenter.net/China_Currents/spring_2007/cc_dehaan.htm >.

#EC #IC *DeHaan, R.L. & K.M. Venkat Narayanl, eds. 2008. *Education For Innovation Implications For India, China And America*. Sense, publisher's information at < http://tinyurl.com/3l5jdb >. The publisher writes (our *italics*):

"In *Education for Innovation: Implications for India, China and America*, distinguished thought leaders explore cutting-edge questions such as: Can inventiveness and ingenuity be taught and nurtured in schools and colleges? What are the most effective educational strategies to promote these abilities? How are vibrant economies driven by innovation? *What is the relationship between education for innovation and national competitiveness or economic development*? Focusing on the Worlds' three most populous countries and largest economies, this book provides a forum for international experts to address a range of critically important issues related to higher education and its role in creating innovative societies."

A free preview of pages 1-19 is online at < http://www.sensepublishers.com/catalog/files/9789087900731.pdf > (668 kB)

#EB *Diamond M. C. 1996. "The Brain. Use It or Lose It." *Mind Shift Connection* **1**: 1; online at < http://www.newhorizons.org/neuro/diamond_use.htm >.

#CE *diSessa, A.A. 1988. "Knowledge in Pieces," in Forman & Pufall (1988), pp. 49-70; online at < http://www.questia.com/PM.qst?a=o&d=13634588 >.

*Doctorow, E.L. 2008. "The White Whale," The *Nation*, 14 July; online at < http://www.thenation.com/doc/20080714/doctorow >. The editors introduction reads:

" In April 2007 in Washington there was a joint meeting of the American Academy of Arts and Sciences and the American Philosophical Society on the theme of "The Public Good: Knowledge as the Foundation for a Democratic Society." E.L. Doctorow's keynote address was titled "The White Whale."

Doctorow begins: "What does it say about the United States today that this fellowship of the arts and sciences and philosophy is called to affirm knowledge as a public good? What have we come to when the self-evident has to be argued as if -- 500 years into the Enlightenment and 230 - some years into the life of this Republic--it is a proposition still to be proven? How does it happen that the modernist project that has endowed mankind with the scientific method, the concept of objective evidence, the culture of factuality responsible for the good and extended life we enjoy in the high-tech world of our freedom, but more important for the history of our species, the means to whatever verified knowledge we have regarding the nature of life and the origins and laws of the universe.... *How does it happen for reason to have been so deflected and empirical truth to have become so vulnerable to unreason*?"

*Donovan, S.M. & J.D. Bransford, eds. 2005. *How Students Learn History, Mathematics, and Science in the Classroom*. Nat. Acad. Press; online at < http://books.nap.edu/catalog/10126.html >.

#IE *Dori, Y.J. & J. Belcher. 2004. "How Does Technology-Enabled Active Learning Affect Undergraduate Students' Understanding of Electromagnetism Concepts?" *The Journal of the Learning Sciences* **14**(2); online as a 1 MB pdf at < http://tinyurl.com/cqoqt >.

Dresselhaus, M.S., J.R. Franz, & B.C. Clark. 1994. "Interventions to increase the participation of women in physics," *Science* **263**: 1392-1393; online to subscribers at
< http://www.sciencemag.org/cgi/reprint/263/5152/1392 >.

Dresselhaus and Franz are listed in "Contributions of 20th Century Women to Physics" [Byers & Colleagues (2008)].

Dresselhaus, M. S., J. Franz, B.C. Clark. 1995. *Improving the Climate for Women in Physics Departments*, American Physical Society and American Association of Physics Teachers, College Park, Md. A summary is online at
< http://www.aps.org/programs/women/sitevisits/summary.cfm >.

Dresselhaus, M.S. 2000. "Strategies and policies to recruit, retain, and advance women scientists," in *Who Will Do the Science of the Future? A Symposium on Careers of Women in Science* [NAP (2000a)], pp. 55-56.

Drew, D.E. 1996. *Aptitude Revisited: Rethinking Math and Science Education for America's Next Century*. Johns Hopkins University Press. Amazon.com information at
< http://tinyurl.com/38jlok >. Note the "Search Inside" feature. For a review see "Raising Expectations" [Campbell (1997)]. Campbell wrote:

"An important thread spanning *Aptitude Revisited* is the limited access to mathematics and science education among traditionally underrepresented groups. 'Women, poor people and disadvantaged minority students consistently are discouraged from studying science and mathematics, the very subjects that would give them access to power, influence and wealth.' "

#IE *Dreifus, C. 2007. "A Conversation With Eric Mazur: Using the 'Beauties of Physics' to Conquer Science Illiteracy," *New York Times*, 17 July, free online for a short time at
< http://www.nytimes.com/2007/07/17/science/17conv.html?_r=1&oref=slogin >.

Copied into the Math-Teach archives at
< http://mathforum.org/kb/thread.jspa?threadID=1597751&tstart=0 > by Jerry Becker in accord the "fair use" provision of the section 107 of the US Copyright Law – see e.g.,
< http://www.law.cornell.edu/uscode/17/107.shtml >.]

*Duschl, R.A., H.A. Schweingruber, & A.W. Shouse, eds. 2007. *Taking Science to School: Learning and Teaching Science in Grades K-8*, National Academies Press; online at < http://books.nap.edu/catalog.php?record_id=11625 >:

"What is science for a child? How do children learn about science and how to do science? Drawing on a vast array of work from neuroscience to classroom observation, *Taking Science to School* provides a comprehensive picture of what we know about teaching and learning science from kindergarten through eighth grade. By looking at a broad range of questions, this book provides a basic foundation for guiding science teaching and supporting students in their learning. *Taking Science to School* answers such questions as:

(a) When do children begin to learn about science? Are there critical stages in a child's development of such scientific concepts as mass or animate objects?
(b) What role does nonschool learning play in children's knowledge of science?
(c) How can science education capitalize on children's natural curiosity?
(d) What are the best tasks for books, lectures, and hands-on learning?
(e) How can teachers be taught to teach science?

The book also provides a detailed examination of how we know what we know about children's learning of science about the role of research and evidence. This book will be an essential resource for everyone involved in K-8 science education teachers, principals, boards of education, teacher education providers and accreditors, education researchers, federal education agencies, and state and federal policy makers. It will also be a useful guide for parents and others interested in how children learn."

For a few mild criticisms see "Re: Natl Academies book" [Hake (2007k)].

#LPE *Duderstadt, J.J. 2000. *A University for the 21st Century*. Univ. of Michigan Press; for a description see < http://tinyurl.com/9lhpl >. On pages 20-21 Duderstadt wrote :

SPACESHIP EARTH: There is mounting evidence that the growing population and invasive activities of humankind are now altering the fragile balance of our planet. The concerns are both multiplying in number and intensifying in severity: the destruction of forests, wetlands and other natural habitats by human activities leading to extinction of millions of biological species and the loss of biodiversity; the buildup of greenhouse gases such a carbon dioxide and their possible impact on global climates; the pollution of our air, water, and land.

With the world population now at 6 billion, we are already consuming 40% of the world's photosynthetic energy production. Current estimates place a stable world population at about 8 to 10 billion by the late twenty-first century, assuming fertility rates continue to drop over the next several decades. Yet even at this reduced rate of population growth, we could eventually consume all of the planet's resources, unless we take action. *Because of this overload of the world's resources, even today, over 1.2 billion of the world's population live below the subsistence level, and 500 million below the minimum caloric intake level necessary for life*. [Our *italics*.]

It could well be that coming to grips with the impact of our species on our planet, learning to live in a sustainable fashion on spaceship earth, will become the greatest challenge of our generation. This will be particularly difficult for a society that has difficulty looking more than a generation ahead encumbered by a political process that generally functions on an election-by-election basis, as the current debate over global change makes all too apparent. *Universities must take the lead in developing knowledge and educating the world's citizens to allow us to live upon our planet while protecting it*. [Our *italics*.]

#SDMA Eccles, J.S & J.E Jacobs. 1986. "Social Forces Shape Math Attitudes and Performance," *Signs: Journal of Women in Culture and Society* **11**(2): 367-380; online to subscribers at < http://www.jstor.org/pss/3174058 >. References that cite this article are given at < http://www.journals.uchicago.edu/doi/abs/10.1086/494229 > .

Education Development Center. 2008. < http://www.edc.org/ > :

a. " Living Life: Stories of Women, Men, and Changing Roles in the 20th Century," online at < http://main.edc.org/Search/viewProject.asp?projectID=3737 >,

b. Gender, Diversities, and Technology Institute < http://main.edc.org/Search/viewProject.asp?projectID=3251 >,

c. The Gender and Science Digital Library < http://main.edc.org/Search/viewProject.asp?ProjectID=3752 >.

Ehrlich, R. 2007. "Where are the female physicists?" *CSWP Gazette*, Fall, online at < http://www.aps.org/programs/women/reports/gazette/upload/GAZ_fall07.pdf > (540 kB. Ehrlich wrote:

"Projections show. . . . . that women may become the majority of science PhD recipients in the United States as soon as 2008. Nevertheless, the under-representation of women in some sciences, most especially physics is far greater than other sciences, and it is unlikely to be reversed in the foreseeable future. With the aid of two recent studies on academic women in physics. . . . .[*Beyond Bias and Barriers: Fulfilling the Women in Academic Science and Engineering* (NAP, 2007), and Chapter 2 "Higher Education in Science and Engineering" of *Indicators 2006* (NSB, 2006)]. . . ., we find several correlations that account for variations in percentages in numbers of women faculty and graduate students in physics and astronomy departments at U.S. Universities. Here we look specifically at how the percentages of women physics faculty tend to correlate with department size, gender distribution of graduate students, geographic location, and departmental selectivity in admissions."

Eisenhart, M.A. & E. Finkel. 1998. *Women's Science: Learning and Succeeding from the Margins*. University of Chicago Press, publisher's information at < http://www.press.uchicago.edu/cgi-bin/hfs.cgi/00/13597.ctl > [Our *italics*.]:

"Are there any places where women succeed in science? Numerous studies in recent years have documented and lamented a gender gap in science and engineering. From elementary school through college, women's interest in science steadily declines, and as adults, they are less likely to pursue careers in science-related fields.

Women's Science offers a dramatic counterpoint not only to these findings but also to the related, narrow assumption that 'real science' only occurs in research and laboratory investigation. This book describes women engaged with science or engineering at the margins: an innovative high school genetics class; a school-to-work internship for prospective engineers, *an environmental action group, and a nonprofit conservation agency*. In these places—*where people use or rely on science for public, social, or community purposes*—the authors found a remarkably high proportion of women. Moreover, these women were successful at learning and using technical knowledge, they advanced in roughly equal percentages to men, and they generally enjoyed their work."

Amazon.com information at < http://tinyurl.com/2963rx >. Note the "Search Inside" feature.

*eLearn magazine. 2008. Online at < http://www.elearnmag.org/index.cfm >: "Online magazine for news, information, and opinion about online education and training from journalists and industry leaders." Archives at < http://www.elearnmag.org/subpage.cfm?section=archives >. Sponsored by the Association for Computing Machinery (ACM) < http://www.acm.org >. Contains valuable interviews by editor Lisa Neal of e-learning gurus such as:
John Seely Brown < http://www.elearnmag.org/subpage.cfm?section=articles&article=37-1 >;
Richard Mayer < http://www.elearnmag.org/subpage.cfm?section=articles&article=38-1 >;
Tom Carey < http://www.elearnmag.org/subpage.cfm?section=articles&article=50-1 >; and
Seb Schmoller < http://www.elearnmag.org/subpage.cfm?section=articles&article=53-1 >.

#IC *Elmore, R.F. 1997. "The Politics of Education Reform," *Issues in Science and Technology Online*, Fall, online at < http://www.issues.org/14.1/elmore.htm >. Elmore wrote (our *italics*) :

> "The recently released Third International Mathematics and Science Study (TIMSS), which made international comparisons of math and science performance among fourth- and eighth-grade students, strengthened the case of those who are calling for ambitious reform of U.S. education. U.S. fourth graders did relatively well in science and about average in math; eighth graders did slightly better than average in science and slightly below average in math. These findings are consistent with other assessments of U.S. student performance.
>
> The TIMSS study also provided new and valuable information about the relationship between instructional practice and student performance. *The message to U.S. educators was clear: science and math education needs to be better focused and more rigorous*. Although one can still hear arguments that international comparisons are not fair, that the diversity of the U.S. population or the pluralistic nature of its political culture makes it impossible to replicate the coherence found in other countries' schools, or that U.S. schools are already improving at an acceptable pace, the reality is that the majority of the public, of elected officials, and of educators believe that change is needed. The task is to determine what changes are necessary to make a real difference to students and how reform can be achieved in the U.S. political culture. . . . . .
>
> In their profound analysis of the history of U.S. education reform, David Tyack and Larry Cuban. . . . [Tyack & Cuban (1995)]. . . . *note the persistent gap between what they call 'policy talk' and the world of daily decisions about what to teach, how to teach, and how to organize schools*. Most reforms, they argue, exist mainly in the realm of policy talk - visionary and authoritative statements about how schools should be different, carried on among experts, policymakers, professional reformers, and policy entrepreneurs, usually involving harsh judgments about students, teachers, and school administrators. Policy talk is influential in shaping public perceptions of the quality of schooling and what should be done about it. *But policy talk hardly ever influences the deep-seated and enduring structures and practices of schooling, which I have called the 'instructional core' of school*."

*Epstein, J. 2007. "Development and Validation of the Calculus Concept Inventory," in *Proceedings of the Ninth International Conference on Mathematics Education in a Global Community*, 7-12 September, edited by Pugalee, Rogerson, & Schinck; online at < http://math.unipa.it/~grim/21_project/21_charlotte_EpsteinPaperEdit.pdf > (48 kB):

> Abstract: "I discuss the development and validation of an instrument known as the *Calculus Concept Inventory* (CCI). Patterned closely on the highly successful *Force Concept Inventory* (FCI, physics). . . . [our insert – Hestenes et al. (1992)]. . . ., it tests conceptual understanding of the *most basic* principles of calculus. Results are discussed, and the future plan that it will serve as a tool for the evaluation of teaching methodologies, as the FCI has been in physics."

Erickson, G.L. and L.J. Erickson. 1984. "Females and science achievement: Evidence, explanations, and implications." *Science Educ*. **68**(2): 63-89; online to subscribers at < http://www3.interscience.wiley.com/journal/112767626/issue >.

Etkina, E., K. Gibbons, B.L. Holton, G.K. Horton. 1999. "Lessons learned: A case study of an integrated way of teaching introductory physics to at-risk students at Rutgers University," *Am. J. Phys*. **67**(9): 810-818; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=67&Issue=9 >. The abstract reads:

> "In order to provide a physics instructional environment in which at-risk students (*particularly women and minorities*) can successfully learn and enjoy introductory physics, we have introduced 'Extended General Physics' as an option for science, science teaching, and pre-health professions majors at Rutgers University. We have taught the course for the last five years. In this new course, we have used many elements that have been proven to be successful in physics instruction. We have added a new component, the minilab, stressing qualitative experiments performed by the students. By integrating all the elements, and structuring the time the students invest in the course, we have created a successful program for students-at-risk, *indeed for all students*. Our aim was not only to foster successful mastery of the traditional physics syllabus by the students, but to create a sense of community through the cooperation of students with each other and their instructors. We present a template for implementation of our program elsewhere." (Our *italics*.)

Etzkowitz, H., C. Kemelgor, & B. Uzzi. 2000. *Athena Unbound: The Advancement of Women in Science and Technology*. Cambridge University Press, publisher's information at < http://www.cambridge.org:80/uk/catalogue/catalogue.asp?isbn=9780521787383 >:

> "Why are there so few women scientists? Persisting differences between women's and men's experiences in science make this question as relevant today as it ever was. This book sets out to answer this question, and to propose solutions for the future. Based on extensive research, it emphasizes that science is an intensely social activity. Despite the scientific ethos of universalism and inclusion, scientists and their institutions are not immune to the prejudices of society as a whole. By presenting women's experiences at all key career stages - from childhood to retirement - the authors reveal the hidden barriers, subtle exclusions and unwritten rules of the scientific workplace, and the effects, both professional and personal, that these have on the female scientist. This important book should be read by all scientists - both male and female - and sociologists, as well as women thinking of embarking on a scientific career."
>
> Amazon.com information at < http://tinyurl.com/2lpvo8 >.

Expanding Your Horizons Network. 2008. Online at < http://www.eyhnet.org/ >. *Expanding Your Horizons in Science and Mathematics* conferences nurture girls' interest in science and math courses to encourage them to consider careers in science, technology, engineering, and math. See < http://www.eyhnet.org/about/ > .

Feder, T. 2002. "Women, and Some Men, Ask Why Women Don't Flock to Physics," *Physics Today* **55**(5): 24; online at < http://scitation.aip.org/journals/doc/PHTOAD-ft/vol_55/iss_5/24_1.shtml>.

> A report on the International Union of Pure and Applied Physics (IUPAP)-sponsored international conference on women in physics held 7 to 9 March 2002 in Paris < http://www.if.ufrgs.br/~barbosa/conference.html >. [See also the reports on this conference in *Science* by Tobias *et al*. (2002) and in *APS News* (2002a).]

Fennema, E. & G.C. Leder. 1990. *Mathematics and Gender*. Teachers College Press. Amazon.com information at
< http://www.amazon.com/Mathematics-Gender-Elizabeth-Fennema/dp/0807730017 >.

Fiore, C. 2007. "Guest Editorial: Gender Equity: Strengthening the Physics Enterprise in Universities and National Laboratories," *CSWP Gazette*, Fall, online at
< http://www.aps.org/programs/women/reports/gazette/upload/GAZ_fall07.pdf > (540 kB).

Finn, R. 1995. "Deficit vs Difference: Study Finds Gender Disparity Even Among High Achievers In Science," *The Scientist* **9**(22), 13 November; online to subscribers at
< http://www.the-scientist.com/article/display/16773/ >. Finn wrote :

> A recently released study from Harvard University examining the careers of scientists who showed high promise as postdocs has found persistent gender differences in career outcomes. The study, called Project Access . . . (Holton & Sonnert 1993). . . reveals clear evidence of a glass ceiling for women in certain fields, notes differences in publication patterns, and elucidates the way that family-related issues-such as raising children and living in a two-scientist household-disproportionately affect women. . . . Project Access is the first of three major studies of gender disparities in science expected to be released over the next few months. A longitudinal study of a matched sample of 92,904 scientists and engineers who received Ph.D.'s between 1973 and 1989 is under review at the National Research Council (NRC), and is expected to be issued by the end of the year. And Mary Frank Fox, a professor of sociology at the Georgia Institute of Technology in Atlanta, will present the results of her survey of 5,400 doctoral candidates and faculty members at the annual meeting of the American Association for the Advancement of Science in February. . .(see Fox (1995-2002) . . . . Sonnert and Holton examine the effects of luck in scientific career paths with reference to a 'kick-reaction model' . . . .(Cole & Singer 1991). . . "A kick is any event in the environment that has a potential effect on the individual's career, be it positive or negative," write Sonnert and Holton. "Likewise, the individual's reaction to a kick can be positive or negative. Over the course of a career, the pattern of kicks and reactions changes." Notes Sonnert, "Negative or positive kicks can be subtle. Several women told stories about how some important decisions are made at a very informal level, maybe not even in the office, but after hours in a bar. And these were things they might not get invited to or might not feel comfortable with. So they would miss out on potential good kicks-that is, being involved in the decision-making."

#MIT Fitzpatrick, S.M. 1999. "The Protégé to Peer Transition," *AWIS Magazine* **28**(3); online at
< http://www.jsmf.org/about/s/protege_to_peer_transition.htm >. Susan Fitzpatrick is Vice President of the James S. McDonnell Foundation < http://www.jsmf.org/ > and a prolific author - see < http://www.jsmf.org/about/spubs.htm >. Fitzpatrick wrote:

> "For some time, I have been mulling over an idea that one hurdle facing women in science is what I call 'the protégé to peer transition.' In a nutshell, I think one of the problems facing women is that men (and to a larger extent, society) are comfortable with women in subordinate roles, but less accepting of women as peers – or superiors. So while women no longer confront overt difficulties entering even the most competitive graduate schools or securing prestigious postdoctoral positions (both of which may provide opportunities for significant recognition and support*), there are still relatively few women scientists in tenured faculty positions or in more senior positions like chairs and deanships*. [Our *italics*.] Yet I was bothered by the fact that my ideas largely were based on anecdote and personal observation. I worried whether I would be able to write something more substantive, and whether I could support my theories with data. Remarkably, just as the deadline was looming—and I still hadn't found quite the right hook to hang my protégé/peer story on *A Study on the Status of Women Faculty in Science at MIT* hit the news . . . .[MIT (1999)]."

*FLAG. 2008. "Field-tested Learning Assessment Guide," online at
< http://www.flaguide.org/ > :

". . . offers broadly applicable, self-contained modular classroom assessment techniques (CAT's) and discipline-specific tools for STEM [Science, Technology, Engineering, and Mathematics] instructors interested in new approaches to evaluating student learning, attitudes, and performance. Each has been developed, tested, and refined in real colleges and university classrooms." Assessment tools for physics and astronomy (and other disciplines) are at < http://www.flaguide.org/tools/tools.php >. See also "Assessment Instrument Information Page" [NCSU (2008a)].

#IPCS *Ford, K.W. 1987. "Guest Editorial: Whatever Happened to *Curriculum S*?" *Phys. Teach.*, March, pp. 138-139; normally online to subscribers at
< http://scitation.aip.org/dbt/dbt.jsp?KEY=PHTEAH&Volume=25&Issue=3 > [Pages 138-139 are currently missing from the March 1987 online issue, but we have been assured by the AAPT that they will soon be added.] Ford wrote (our *italics*):

"From the . . . . . second Ann Arbor Conference, November 1962 - came a succinct and memorable recommendation: that two kinds of curricula for physics majors be developed (to meet the needs of two kinds of students). These were named curriculum R and curriculum S. Curriculum R (for Research) was the then-current (and still dominant) undergraduate curriculum, whose principal aim is to prepare students for graduate study. *Curriculum S (for Synthesis) was to serve students who wanted to study physics as background for something other than physics research: business, law, medicine, teaching, some other scientific study, or just informed citizenship*. What has happened? Sad to say, nothing. Curriculum R was already strong and is still strong. *Curriculum S did not exist then and it does not exist now* (in first approximation). . . . *It is time to look again at Curriculum S* . . . . We need majors with aspirations other than physics research. Ours is an exciting field, a central part of the liberal arts. It provides a useful background for many activities. Should we not promote its serious study by future teachers, lawyers, and business people? Above all, *we need a physics major program suitable for (and attractive to) some of the teachers of the next generation - not just high-school physics teachers, but elementary and middle school teachers as well*."

#CE *Forman, G. & P.B. Pufall. 1988. *Constructivism in the Computer Age*. Lawrence Erlbaum; online at < http://www.questia.com/PM.qst?a=o&d=13634588 >.

Fort, D.C., ed. 2005. *A Hand Up: Women Mentoring Women in Science*, Association for Women in Science; 2nd edition. Amazon.com information at < http://tinyurl.com/57duds > :

"Product Description:
New from the Association for Women in Science: *A Hand Up: Women Mentoring Women in Science*. Contributing Editor: Deborah C. Fort, Ph.D Contributors: Some 60 distinguished scientists. This new edition of the Association for Women in Science's classic paper mentor has been thoroughly revised to reflect the realities women in science, mathematics, technology, and engineering face in the new millennium. Through interviews and essays, both veteran women in science and others new to the field offer specific and practical insights, advice, and assistance to females who would enter scientific fields and to those already there. Virtually every contributor offers to serve as a mentor and/or to try to provide any advice sought to any women scientist in search of help. Contact information accompanies all 37 interviews with women scientists, postdoctoral fellows, and students. *A Hand Up* concludes with a section guiding aspiring women scientists to organizations, electronic resources, and how-to practical recommendations in their searches for successful professional outcomes. Some barriers have been breached; others remain for women scientists in general and for Hispanic ones in particular. To investigate and mitigate such hurdles, AWIS describes the struggles and triumphs of the latter group in particular detail. AWIS sees the audience for its second edition as compromising not only individual scientists young and old, male and female, in search of mentors or protégées but also libraries, general and scientific, and university courses in both the sciences and women's studies."

Fox, M.F. 1991. "Gender, Environmental Milieu, and Productivity in Science," in Zuckerman *et al*. (1991).

Fox, M.F. 1995. "Women and Scientific Careers," in S. Jasanoff *et al*. eds. (2001), *Handbook of Science and Technology Studies*. Sage. pp. 205-223.

Fox, M.F. 1996. "Women, Academia, and Careers in Science and Engineering," in C.S. Davis et. al. (1996).

Fox, M.F. 1998. "Women in Science and Engineering: Theory, Practice and Policy Programs." *Signs* 42(1): 201-223; first page is online at < http://tinyurl.com/3h7xs9 >.

Fox, M.F. 1999. "Gender, Hierarchy, and Science," in *Handbook of the Sociology of Gender*, J. S. Chafetz, ed. pp. 441-457. Kluwer Academic/Plenum Publishers, publisher's information at < http://www.springer.com/social+sciences/sociology/book/978-0-306-45978-8 >. A Google "preview" of the *Handbook* is online at < http://tinyurl.com/3kvkd9 >.

Fox, M.F. 2000. "Organizational Environments and Doctoral Degrees Awarded to Women in Science and Engineering Departments," *Women's Studies Quarterly:* "Building Inclusive Science: Connecting Women's Studies and Women in Science and Engineering" **28**(1&2): 47-61; publisher's information at < http://feministpress.org/book/?GCOI=55861100814380 >.

Fox, M.F. 2001. "Women, Science, and Academia: Graduate Education and Careers," *Gender & Society* 15 (October): 654-666; abstract online at < http://gas.sagepub.com/cgi/content/abstract/15/5/654 >.

Fox, M.F. & P. Stephan. 2001. "Careers of Young Scientists: Preferences, Prospects, and Realities by Gender and Field," *Social Studies of Science* 31 (February): 109-122; abstract online at < http://sss.sagepub.com/cgi/content/abstract/31/1/109 >.

Fox, M.F. 2002. "Gender, Faculty, and Doctoral Education in Science and Engineering," in *Equal Rites, Unequal Outcomes: Women in American Research Universities*, L. Hornig, ed., Kluwer Academic/Plenum. Amazon.com information at < http://www.amazon.com/Equal-Rites-Unequal-Outcomes-Universities/dp/0306473518 >. Note the "Search Inside" feature:

> Book Description: This book is based on a conference held at Harvard University in November 1998. It is sponsored by grants from the Ford Foundation, the Sloan Foundation, and the Albert Gordon Foundation. The intent of the conference is to focus on women faculty in research universities, seeking to identify and disseminate innovative approaches to increasing faculty positions and opportunities for women there. Faculty positions in these institutions are essential to establishing productive scholarly careers, especially so in the natural sciences, but also in the social sciences and humanities. The contributors are considered quite stellar and are some of the most important leaders in their individual fields of study.

Fox, M.F., D.G. Johnson, & S.V. Rosser, eds. 2006. *Women, Gender, and Technology*. University of Illinois Press, publisher's information at < http://www.press.uillinois.edu/books/catalog/56nms5yx9780252030956.html >.

Fox, M.F. 2008a. "Institutional Transformation and the Advancement of Women Faculty: The Case of Academic Science and Engineering," in *Higher Education: Handbook of Theory and Research*, vol. 23 [Smart (2008)].

Fox, Mary Frank. 2008b. Homepage at Georgia Tech < http://www.spp.gatech.edu/hrst/fox.html >.

Franz, J.R. 1995. "Improving the Climate for Women in Physics," APS & AAPT Department Chairs Conference; online at < http://www.aps.org/programs/education/chairs/1995/upload/climate.pdf > (28 kB).

Frehill, L.M. & N. Di Fabio. 2007. "Women's Representation in Mathematics," *AWIS Magazine*, Summer, online at < http://www.awis.org/pubs/documents/Summer2007pdf_000.pdf > (4.2 MB). Frehill & DiFabio wrote:

> ". . . . . at 29%, women at the assistant professor level are pretty much on par with their representation among the 2005 doctoral recipients. The major hurdle that remains for women doctorate holders in mathematics who are able to obtain faculty positions is the 'leap' to senior faculty status: only 11.8% of associate and full professors with doctoral degrees in mathematics are women."

Freitag, R.S. "Women in Astronomy: A Comprehensive Bibliography," Science Reference Services, Library of Congress, online at < http://www.loc.gov/rr/scitech/womenastro/womenastro-intro.html >.

#SDMA Friedman, L. 1989. "Mathematics and the gender gap: A meta-analysis of recent studies of sex differences in mathematical tasks," *Review of Educational Research* **59**(2): 185-213; online at < http://rer.sagepub.com/cgi/reprint/59/2/185 > :

"This paper is a meta-analysis of studies that have taken place between 1974 and mid-1987 on sex differences in mathematical tasks. The methods used are estimations of (a) parameters for a random effects model and (b) coefficients for a linear regression equation, all based on effect sizes calculated from each study. These results are compared with meta-analyses of the studies on quantitative skill collected by Maccoby and Jacklin. These comparisons, together with ad hoc comparisons of Scholastic Aptitude Test effect sizes over the years, yield two conclusions. First, the average sex difference is very small; a confidence interval for it covers zero, though the interval lies mainly on the side of male advantage. Second, sex differences in performance are decreasing over the years."

#SV Friedman, L. 1995. "The space factor in mathematics: gender differences," *Review of Educational Research* **65**(1): 22-50. Abstract online at < http://rer.sagepub.com/cgi/content/abstract/65/1/22 >. Friedman wrote :

"The relationship of spatial and mathematical skills has been the subject of both speculation and empirical investigation. A meta-analysis of correlations of spatial and mathematical skills has found that these are not high, and that correlations of verbal and mathematical skills are higher. Many researchers have suggested that the space-math relationship may be gender-specific. The further meta-analytic results reported here show that in selected samples, math-space correlations are higher in females than in males, with the difference becoming more pronounced with greater selectivity. Because these samples are of gifted or college-bound youth, explanations which emphasize career-directed attitudes in the interplay of spatial and mathematical skills are suggested."

#IE Froyd. J. 2007. "Evidence for the Efficacy of Student-active Learning Pedagogies," online at < http://cte.tamu.edu/programs/scl.php > (188 kB). The summary is:

"Although many resources have been published on improvements in student retention and/or learning as a result of using what can be referred to as student-active pedagogies, the resources are published in a variety of journals or on various websites. As a result, it may be difficult for an individual to locate and assemble these resources to support an argument in favor of using these alternative pedagogies. Over a period of eight years, including my time as the Project Director for the Foundation Coalition, one of the Engineering Education Coalitions supported by NSF, I have tried to assemble many of these resources in one place for easy reference."

*Fuller, R., S. Agruso, J.V. Mallow, D. Nichols, R. Sapp, A. Strassenburg, G. Allen. 1985. "Developing Student Confidence in Physics," Workshop manual, Amer. Assoc. of Physics Teachers, College Park, Maryland. See also Fuller (1993).

*Fuller, R.G. 1993. "Millikan Lecture 1992: Hypermedia and the knowing of physics: Standing upon the shoulders of giants," *Am. J. Phys.* **61**(4): 300-304; online at < http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1010&context=physicsfuller >.

*Fuller, R.G., ed. 2002. *A Love of Discovery: Science Education - The Second Career of Robert Karplus*. Kluwer. This is a valuable resource containing seminal papers of Karplus and his colleagues. Amazon.com information at < http://tinyurl.com/ypv275 >. Note the "Search Inside" feature.

#SDMA Gallagher, A.M. & J.C. Kaufman, eds. 2005. *Gender Differences in Mathematics: An Integrative Psychological Approach*. Cambridge University Press (CUP), publisher's information at
< http://assets.cambridge.org/97805218/26051/sample/9780521826051ws.pdf > (148 kB):

"Females consistently score lower than males on standardized tests of mathematics – yet no such differences exist in the classroom. These differences are not trivial, nor are they insignificant. Test scores help determine entrance to college and graduate school and therefore, by extension, a person's job and future success. If females receive lower test scores then they also receive fewer opportunities. Why does this discrepancy exist? This book presents a series of papers that address these issues by integrating the latest research findings and theories. Authors such as Diane Halpern, Jacquelynne Eccles, Beth Casey, Ronald Nuttal, James Byrnes, and Frank Pajares tackle these questions from a variety of perspectives. Many different branches of psychology are represented, including cognitive, social, personality/self-oriented, and psychobiological. The editors then present an integrative chapter that discusses the ideas presented and other areas that the field should explore."

Reviewed by Linn & Kessel (2006).

A Google 'book preview" is online at < http://tinyurl.com/5cy7hz >.

*Gardiner, L. 1998. "Why We Must Change," *NEA Higher Education Journal* **71**: 121-138; online < http://www2.nea.org/he/heta00/images/f00p121.pdf > (84 kB). Gardiner wrote (our *italics*) :

"Most faculty work long and hard. We care about educating our students. Thanks to our efforts, many of them experience deep personal transformation during their college years. However, *when we subject the quality of our collective work as educators to the same close examination we demand in our disciplines, we find a substantial body of evidence that clearly demonstrates a crisis of educational quality in our nation's colleges and universities*."

*Gardiner, L. 1996. *Redesigning Higher Education: Producing Dramatic Gains in Student Learning*. John Wiley. Amazon.com information at
< http://tinyurl.com/6h9oqu >. Note the "Search Inside" feature.

GASAT#4. 1987. *Girls and Science and Technology*, Proceedings of the 4th International GASAT 4. Conference, Ann Arbor, Michigan, July 24-29, edited by Jane Zimmer Daniels & Jane Butler Kahle, online at ERIC as a scanned 39.2 MB pdf at < http://tinyurl.com/23eubj >.

GASAT#7. 1993. *Transforming Science And Technology : Our Future Depends On It,* edited by Sharon Heggerty & Ann Holmes. University of Waterloo; publisher's information at
< http://www.biblio.com/details.php?dcx=144164896&aid=frg >.

GASAT#8. 1996. "Papers from GASAT 8, Ahmedabad, India, January 1996; online at
< http://archive.wigsat.org/gasat/index.html >.

GASAT#11. 2003. *Proceedings of the 11th International GASAT Conference, 6th - 11th July 2003 Mauritius*, edited by Jaya Naugah, Pritam Parmessur, Yashwant Ramma, Anita Ramdinny,. & Praveen Mohadeb; online at
< http://www.gasat-international.org/conferences/G11Mauritius/proceedings/proceedings.pdf > (456 kB).

GASAT. 2008. Gender And Science And Technology, online at < http://www.gasat-international.org/gasat12.html/ >. NOTE – This URL was dead on 27 April 2008, but previously we had copied the following from that site:

"The GASAT Association has evolved over the years since the first conference in 1981.The objectives of the GASAT Association are:

1. To encourage research into all aspects of gender differentiation in science and technology education and employment,
2. To foster gender equity in science and technology, in education and in the workplace.
3. To facilitate the entry of women into employment in the fields of science and technology, and their progress within such employment.
4. To foster socially responsible, environmentally sustainable and gender-inclusive science and technology.
5. To provide a forum for dissemination and discussion of research findings and experiences of those working in the field.
6. To provide an international network for those working towards the objectives outlined above.

International Conferences have been held in: The Netherlands, 1981; Norway, 1983; UK, 1985; USA, 1987; Israel, 1989; Australia, 1991; Canada, 1993; India, 1996; Ghana, 1999; Denmark, 2001; and Mauritius, 2003. Regional conferences have also been held in many parts of the world. Each conference has developed its own themes related to national and world issues."

GASAT International. 2008. Gender And Science And Technology, online at < http://www.gasat-international.org/ > :

"Gender And Science And Technology (GASAT) Association is an international association concerned with issues arising from interactions between Gender and science and technology. Members are found across the globe. GASAT made vital contributions towards the inclusion of science and technology in the Platform of Action during the 4th UN Conference on Women (Beijing, 1995) and is an active member of the Once and Future Action Network (OFAN)."

The GASAT Board is online at < http://www.gasat-international.org/about%20gasat/board.htm >, but the links to "Gasat 12 Conference < http://www.gasat12.org.uk/ > and "Links" were dead on 20 March 2008.

As far as we know, as of 2008, there had been twelve GASAT international conferences:

#1: 1981, Eindhoven, Netherlands;
#2: 1983, Oslo, Norway;
#3: 1985, London, UK;
#4*: 1987, Ann Arbor, USA;
#5: 1989, Haifa, Israel;
#6: 1991, Melbourne, Australia;
#7*: 1993. Waterloo, Canada;
#8*: 1996, Ahmedabad, India
#9: 1999, Accra, Ghana;
#10: 2001, Copenhagen, Denmark;
#11*: 2003, Mauritius, Africa;
#12: 2006, Brighton, U.K.

The asterisks indicate those conferences for which the Proceedings are available and referenced in this document: [GASAT 4 (1987), GASAT 7 (1993), GASAT 8 (1996), and GASAT 11 (2003). GASAT Proceedings are sometimes distributed to conference attendees, but – unfortunately – except for the above four, do not appear to be generally available in libraries or on the web. Google < http://www.google.com/ > searches for "GASAT N" where $1 \leq N \leq 12$, yield many hits, indicating that articles WERE contributed, but these are generally not available on the web or in libraries **:-(**. Some of the GASAT papers that are not generally available have been referenced in the present compilation.

For an exhortation to GASAT organizers to make Proceedings generally available on the web see Lesley Parker's (2003) contribution to GASAT #11. She wrote (our *italics*):

". . . .how compete and accessible is the archive of GASAT contributions? As I indicated at the outset of this paper, some conference records were not available to me, and the fact that I had access to others was in some cases quite fortuitous. The establishment of the web-site for GASAT in the early 1990s, and its more recent consolidation, has been a major breakthrough, but *we need to move now to ensure that a complete record of all of our conferences can be accessed through that web-site*. I suggest we need a protocol for our publications. Even a cursory glance at what is available demonstrates inconsistencies: some have ISBN numbers, some do not; some have titles, some do not; some are officially attributed to Editors, some are not; and so on. If we want our work to be part of the academic canon, we must ensure that it is as professionally presented as possible. This, of course, has resource implications, and will need considerable discussion and dedication. It is not too much to expect, however, of an organisation which is now 22 years old."

Lesley Parker was Senior Deputy Vice-Chancellor of Curtin University of Technology (1997 to 2004) and Inaugural Director of the national Carrick Institute of Learning and Teaching in Higher Education (2005-06).

Gates, E. 2006. Opinion piece "A Scientific Point of View," *Physics Today* **59**(4): 64-65; online to subscribers at < http://www.physicstoday.org/vol-59/iss-4/p64.shtml >. Gates wrote:

"The latest American Institute of Physics data reveal that in 2002 women represented 5% of full professors in physics (up from 3% in 1998) and the overall percentage of women physics faculty at all levels, including non-tenure-track, is 10%. While the number of women hired into faculty positions is commensurate with the available candidate pool—the leaky pipeline appears to be fixed at the graduate school and faculty levels—the numbers themselves remain embarrassingly low. Other professions and academic fields have made much greater advances over the same 25-year period, and the gap continues to widen. We have been left far behind the physicians, lawyers, biologists, and most of the physical sciences." (See the "Further reading" list at < http://www.physicstoday.org/vol-59/iss-4/p64.shtml#ref >.)

Responses by Vicente Aboites, Jerry & Wei Smith, E.O. LaCasce, Robert K. Adair, Joseph Spicatum, Kamyar Hazaveh; and a reply by Gates are in *Physics Today* **59**(12): 10 < http://scitation.aip.org/journals/doc/PHTOAD-ft/vol_59/iss_12/10_1.shtml >.

#IE *Gautreau, R. and L. Novemsky. 1997. "Concepts First-a Small Group Approach to Physics Learning," *Am. J. Phys.* **65**(5): 418-429; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=65&Issue=5 >.

#EB Geary, D.C. 1998. *Male, Female: The Evolution of Human Sex Differences*. American Psychological Association, publisher's information at < http://books.apa.org/books.cfm?id=431608A >.

David Geary < http://web.missouri.edu/~gearyd/ > "is a cognitive developmental psychologist with interests in mathematical learning and in evolution."

#EB Geary, D.C. 2002. "Principles of evolutionary educational psychology," *Learning and Individual Differences* **12**: 317–345, online to subscribers at < http://tinyurl.com/2zo3uq >.

#EB Geary, D.C. 2005. *The origin of mind: Evolution of brain, cognition, and general intelligence*. American Psychological Association. Publisher's information at < http://books.apa.org/books.cfm?id=4318015 >.

#EB Geary, D.C. 2006. "An Evolutionary Perspective on Sex Differences in Mathematics and the Sciences," in Ceci & Williams (2006).

#EB Geary, D.C. 2007. *Educating the evolved mind: Conceptual Foundations for an Evolutionary Educational Psychology*, a volume in the series *Psychological Perspectives on Contemporary Educational Issues edited by* J.S. Carlson & J.R. Levin, Information Age, publisher's information at < http://www.infoagepub.com/products/content/978-1-59311-612-5.php >. For a review see Taber (2007).

#SV *Geary, D.C. & M.C. DeSoto. 2001. "Sex differences in spatial abilities among adults from the United States and China: Implications for evolutionary theory." *Evolution and Cognition* **7**: 172-177; online at < http://web.missouri.edu/~gearyd/Geary&DeSoto.pdf > (1.2 MB). The abstract reads:

"Sex differences on tests of spatial abilities were examined for two samples of adults from the United States (U.S.) and China. In Study 1, an inconsistent pattern of sex differences emerged for tests that largely required subjects to mentally rotate representations of geometric figures in two dimensions. A male advantage on the Mental Rotation Test (MRT), a test that requires subjects to mentally rotate geometric figures in three dimensions, was found for both the U.S. (n = 66) and Chinese (n = 40) samples. Study 2 included larger samples and replicated the sex difference on the MRT. It was also shown that in both the U.S. (n = 237) and China (n = 218), males were over-represented at the high end of MRT scores, and females were over-represented at the low end of MRT scores. The results support the position that the male superiority in 3-dimensional spatial cognition is not dependent upon culture."

Gebbie, K. 1996. "Why Encourage Women To Enter Physics?" *APS News*, July; online at < http://www.aps.org/publications/apsnews/199607/views.cfm >; Gebbie was the 1996 chair of the APS Committee on the Status of Women in Physics (CSWP) – see APS (2002):

"Why encourage women to make careers in physics? Is it fair to them? Will they not simply swell the numbers of unemployed and underemployed physicists?"

J. Robert Schrieffer, APS President, gave the following answer to these questions:

"...We believe that our goal of advancing and diffusing the knowledge of physics is best served if the profession draws upon the widest possible spectrum of talented individuals. We are therefore committed to removing barriers that limit the participation of women in physics and to making available to women the same range of career choices traditionally open to men. Women have the right, the need and the talent to compete for these opportunities..."

Howard Georgi of Harvard stated:

"If science is to thrive, we must make it our goal to achieve a scientifically literate society, a population that understands and values the contributions that science can make to our national well-being. Women are half that population. Only when women see that women are participating fully in the scientific endeavor-as researchers in the laboratory, as scientific leaders, and as policy makers-will they feel equal partners in a technological society."

Sheila Tobias (1994) wrote:

"No one should be encouraged to 'go into' physics. You should pursue a career in physics when you are called to it - when your love for the beauty of this way of looking at the world makes other choices impossible. It is not supposed to be easy. Except for a few extraordinary times in history, it hasn't been. But everyone should be encouraged to explore physics, to learn about it, and to have the chance to learn to love it. The wrong that the CSWP tries to set right is that at every level of our educational and professional structure, there are obstacles that make it more difficult for women than for men to have this opportunity. If we can remove these barriers, then more women will be called to physics careers. Indeed, this may make it more difficult for everyone who is called. At the same time, however, I believe that new opportunities for careers in physics will open up. This is a critical time for the future of science in the United States."

[#AA] Gelernter, D. 2000. "Women and Science at Yale," *STATUS*, January; online at < http://www.aas.org/cswa/status/status_jan00.pdf > (256 kB). Gelernter wrote (our *italics*):

> "Affirmative action seems to be entering a new phase: As the public turns against it, universities are growing increasingly desperate in their support. *I teach at Yale, where the administration has made it clear that (in particular) it wants more female professors in technology and the hard sciences*. Other universities have the same goal; they have longed for women scientists for years, but their longing seems to have entered a new phase of grim determination. . . .the Yale administration is doing the academic world no favor by joining the crowd that has gathered to poke and prod this particular hornets' nest. The approaching hornet swarm is bad news for universities and society in general. Whether or not you approve of affirmative action, it's clear that certain of its goals can be achieved and others can't. If you are determined, say, to increase the proportion of Hispanics in your undergraduate population, you can probably do it; Hispanic applicants are available. *If your goal is a large increase in female science and engineering professors, you can't do it, because the candidates are not available*." (Our *italics*.)

Gender and Society. 2008. Online at < http://gas.sagepub.com/ >; archives at < http://gas.sagepub.com/archive/ >.

[#EC] George, Y.S., D.S. Neale, V. Van Horne, and S.M. Malcom. 2001. *In Pursuit of a Diverse Science, Technology, Engineering, and Mathematics Workforce: Recommended Research Priorities to Enhance Participation by Underrepresented Minorities*. American Association for the Advancement of Science, online at < http://ehrweb.aaas.org/mge/Reports/Report1/AGEP/AGEP_report.pdf > (3.7 MB). From the Introduction (our *italics*):

> "*Building a diverse workforce* in science, technology, engineering and mathematics (STEM) *is increasingly important to sustaining the nation's productivity and economic strength*. Evidence already exists that the lack of United States citizens in the STEM workforce is limiting economic growth, and business has looked to H-1B Visas (guest workers) as a way to fill this gap. However, recognizing the connection between sustained economic growth. . . .[our insert - is "sustainable growth" an oxymoron? See Bartlett (1998)]. . . . and a technically trained workforce, other nations are aggressively restructuring higher education and workforce policies to keep their nationals at home."

Georgi, H. 2000a. "Is There an Unconscious Discrimination Against Women in Science*?" APS News,* January; online (for APS members) at < http://www.aps.org/publications/apsnews/200001/back-page.cfm >. Georgi wrote:

> "Much progress has been made by women in science in the last 25 years, but 'unconscious discrimination' still remains. I offer the following tentative theory. . . [see Georgi (2000b)]. . . of unconscious discrimination, along with possible strategies for improving the situation. While I have struggled with these issues, I wish to emphasize that I am not an expert. This is a personal attempt to understand the troubling fact of gender discrimination that I see in science."

Georgi, H. 2000b. "A Tentative Theory Of Unconscious Discrimination Against Women In Science," in Who *Will Do the Science of the Future? A Symposium on Careers of Women in Science* [NAP (2000)], pp. 45-48. Georgi wrote:

> ". . . . our selection procedures tend to select not only for talents that are directly relevant to success in science, but also for *assertiveness* and *single-mindedness*. This causes problems for women (and others as well). There are probably other gender-linked traits that we also select for, but I will focus on these two because I think that they are particularly obvious and damaging." (Our *italics*.)

#AA Georgi, H. 2000c. "Views From an Affirmative Activist," *STATUS*, January; online at < http://www.aas.org/cswa/status/status_jan00.pdf > (256 kB). Georgi wrote:

> "Affirmative action seems to have become a divisive issue. I think that this is sad, because I believe that there are situations in which it should not be controversial, if properly understood. I feel strongly that affirmative action to encourage women in science continues to be important, and today I want to explain why. In my view, there are two basic and related issues — evaluation and climate. I firmly believe that improvements in these areas will be good for everyone, not just women."

Glazer-Raymo, J.S., B. K. Townsend, B. Ropers-Hulman, eds. 2000. *Women in Higher Education: A Feminist Perspective*. Pearson, 2nd edition. Amazon.com information at < http://tinyurl.com/2kq3ws >.

Glazer-Raymo, J., ed. 2008. *Unfinished Agendas: New and Continuing Gender Challenges in Higher Education*. Johns Hopkins University Press, publisher's information at < http://www.press.jhu.edu/books/title_pages/9363.html >.

Google. 2001, 2002, 2008. Google searches undertaken during the preparation of GIPSE (2002) in July 2002, and then about 6 years latter during the preparation of GISME (2008) in March and April 2008, allow an indication of changes with time of some gender-related material on the internet. Google's search engine at < http://www.google.com/ > yielded the following numbers of hits at the indicated times:

	IN JULY 2002	IN MARCH 2008	2008/2002
"women physics" (without quotes):	715,000	1,140,000	1.59
"gender physics"(without quotes):	248,000	2,490,000	10.04
"female physics"(without quotes)	255,000	800,000	3.14
"Women's Studies" (with quotes):	434,000	4,760,000	10.97
"Women's Resource Center" (with quotes):	24,400	124,000	5.08

Of course, the large 2008/2002 ratios may be partially due to more efficient searching. However, the following searches suggest that Google searche *can* be used to follow trends:

	IN JULY 2001	IN APRIL 2008	2008/2001
A. "Seven Principles" (with quotes):	848,000	395,000	0.46

	IN MAY 2001	IN APRIL 2008	2008/2001
B. "Minute Paper" (with quotes):	1,050,000	52,500	0.05

	IN FEB 2002	IN APRIL 2008	2008/2002
C. "Deep Learning" (with quotes):	7,110	115,000	16.2
"Mastery Learning"(with quotes)	8,800	100,000	11.4

Searches "A" and "B" for topics which one might expect to have become *less* fashionable show 2008/2001 ratios that are *less* than 1.0, whereas Search C for a topics which one might expect to have become *more* fashionable show 2008/2002 ratios that are greater than 1.0. In addition, the apparently successful use of Google searches to track the rise and fall of cliches in the media over 3-month periods by *The Progressive Review's* < http://www.prorev.com/ > "Cliche Challenge" < http://prorev.com/cliche.htm > again suggest that Google searches *can* be used to get a rough idea of trends.

#EC *Gordon, B. 2007. "U.S. Competitiveness: The Education Imperative,' *Issues in Science and Technology*, Spring, online at < http://www.issues.org/23.3/gordon.html >. Gordon wrote:

"Because the foundation for future success is a well-educated workforce, the necessary first step in any competitiveness agenda is to improve science and mathematics education."

Bart Gordon (D-TN) chairs the Science and Technology Committee of the U.S. House of Representatives.

Responses by Leon Lederman and Camilla Benbow are at < http://www.issues.org/23.4/forum.html > [Scroll down to "Education and U.S. competitiveness."] Lederman wrote:

"U.S. post–World War II prosperity emerged from a huge investment (the G.I. Bill) in our human resources and a strong and continuing contribution from immigration. For decades, some 60% of our graduate schools were occupied by immigrants. About half of these students returned home and half stayed to contribute to a vibrant S&T workforce. However, as anticipated by Alan Greenspan, over time and for a variety of reasons, our educational system began to fail and our immigration began to decline. Today, we are witnessing the results of this double whammy. Our primary-school teachers are emerging from teachers' colleges as ignorant as ever of math and science. U.S. students begin to turn off in early grades. Our middle- and high-school curricula are out of the 19th century, and the 'system' of 50 states, 15,000 school boards, 25,000 high schools, teachers' unions, PTAs, and textbook publishers, and the wide diversity of public school education, all provide an awesome challenge. We need not to fine-tune around the edges but to transform this impossible system."

Amazon.com (probably illegally) hawks the free online responses of Lederman & Benbow for $9.95 at < http://tinyurl.com/3j69fe >.

#SSIGD Gordon, C. 2005. "Response . . . [To Summers]. . . from the AWM Community," online at < http://www.awm-math.org/response.html > also contains "Responses of other mathematical sciences organizations." Carolyn Gordon was, at the time, president of the Association for Women in Mathematics.

Gornick, V. 1990. *Women in Science: 100 Journeys into the Territory*. Touchstone Books. Amazon.com information at < http://tinyurl.com/ypzu5x >.

#CS *Gottfried, K. and K.G. Wilson. 1997. "Science as a cultural construct," *Nature* **386**: 545 - 547. They attack the "strong program" of the Edinburgh school of sociological constructivists. A brief summary with references (some hot-linked) is online at < http://www.nature.com/nature/journal/v386/n6625/abs/386545a0.html >. Gottfried & Wilson wrote:

"Scientific knowledge is a communal belief system with a dubious grip on reality, according to a widely quoted school of sociologists. But they ignore crucial evidence that contradicts this allegation."

Gould, P. 1997. "Women and the culture of university physics in late nineteenth-century Cambridge," *British Journal for the History of Science* **30**: 127-150; online to subscribers at < http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=817 >.

Gould, P. 2002. "Portraits of Science: Two Good Women, or Too Good to Be True?" *Science* **296**(7): 1805-1806; online at < http://tinyurl.com/2wsecn >.

#CE & CS *Grandy, R. 1997. "Constructivisms and Objectivity: Disentangling Metaphysics from Pedagogy," *Science and Education* **6**: 43-53; abstract online at < http://tinyurl.com/6em2x4 > (our *italics*):

> "We can distinguish the claims of cognitive constructivism from those of metaphysical constructivism, which is almost entirely irrelevant to science education. *Cognitive constructivism has strong empirical support and indicates important directions for changing science instruction*. It implies that teachers need to be cognizant of representational, motivational and epistemic dimensions which can restrict or promote student learning. The resulting set of tasks for a science teacher are considerably larger and more complex than on the older more traditional conception, but the resources of cognitive sciences and the history of science can provide important parts of the teachers intellectual tool kit. A critical part of this conception of science education is that students must develop the skills to participate in epistemic interchanges. They must be provided opportunities and materials to develop those skills and the classroom community must have the appropriate features of an objective epistemic community."

Gray, M. 2002. "Gender and Mathematics: Mythology and Misogyny," in *Towards Gender Equity in Mathematics Education: An ICMI Study- Part 1*; online to subscribers at < http://www.springerlink.com/content/w25632418x2435tn/ >. Gray wrote:

> "The disadvantages faced by women in mathematics in career access and earning power are not accounted for by cognitive and psycho-social gender differences (Linn & Hyde, 1993). Thus the mythology does not explain the reality. Does the misogyny?"
>
> ICMI = International Commission on Mathematics Education
> < http://www.mathunion.org/ICMI/ >.

Greenwald, S.J. & A. Nestler. 2006. "Girls Just Want to Have Sums" in *simpsonsmath.com* online at < http://www.mathsci.appstate.edu/~sjg/simpsonsmath// > .

* Greer. B. 2008. "Guest Editorial: Report of the National Mathematics Advisory Panel," *The Montana Mathematics Enthusiast* (TMME) **5**(2&3): 365; online as a 136 kB pdf at < http://tinyurl.com/5u3bsv >. Other articles in TMME's special section "Critical Notice On The National Mathematics Advisory Panel Report" are online at < http://www.math.umt.edu/TMME/vol5no2and3/ >. We thank Jerry Becker for bringing this reference to our attention in a Math-Teach post of 23 June 2008.

Grinstein, L.S., R. K. Rose, M.H. Rafailovich, eds. 1993. *Women in Chemistry and Physics: A Biobibliographic Sourcebook*. Greenwood Press. Amazon.com information at < http://tinyurl.com/2p2ax8 >.

#IC #SDMA Guiso, L., F. Monte, P. Sapienza, & L. Zingales. 2008. "Diversity: Culture, Gender, and Math - Analysis of PISA results suggests that the gender gap in math scores disappears in countries with a more gender-equal culture," *Science* **320**(5880): 1164 - 1165, 30 May; online to subscribers at < http://tinyurl.com/5wwehg >. An abstract is online at < http://www.sciencemag.org/cgi/content/summary/320/5880/1164 >. The entire article is free online on the Math-Teach archives < http://mathforum.org/kb/thread.jspa?threadID=1757413&tstart=0 >, thanks to Jerry Becker.
[Becker's use of copyrighted material is in accord the "fair use" provision of the section 107 of the US Copyright Law – see e.g., < http://www.law.cornell.edu/uscode/17/107.shtml >.]

#EB Gur, R.C. & R.E. Gur. 2006. "Neural Substrates for Sex Differences in Cognition," in Ceci & Williams (2006).
See also "Can Neuroscience Benefit Classroom Instruction?" [Hake (2006c)] and "Scientific and Pragmatic Challenges for Bridging Education and Neuroscience" [Varma *et al*. (2008)].

Gustafsson, P. 2005. "Gender inclusive physics education—a distance case," *Eur. J. Phys.* **26**: 843-849; abstract online at < http://www.iop.org/EJ/abstract/0143-0807/26/5/017 >.

#CE #CS *Hackett, E.J., O. Amsterdamska, M. Lynch and J. Wajcman, eds. 2007. *The Handbook of Science and Technology Studies, Third Edition*. MIT Press, publisher's information at < http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=11368 > :
Endorsement:
"This *Handbook* does a superb job making sense of critical terrains where diverse sorts of expertise, bumptious publics, and generative practices of engagement are reshaping knowledges and their consequences under the sign of technoscience. It goes without saying that the bibliographies are full and tasty and the scholarly reviews invaluable for anyone who wants to be literate in our capacious field. It needs saying that many of the essays succeed in being inspiring, making me remember why a life in STS is worth the price of admission." -- Donna Haraway, History of Consciousness Department, University of California, Santa Cruz

#EB Haier, R.J. 2006. "Brains, Bias, and Biology: Follow the Data," in Ceci & Williams (2006).
See also "Can Neuroscience Benefit Classroom Instruction?" [Hake (2006c)] and "Scientific and Pragmatic Challenges for Bridging Education and Neuroscience" [Varma *et al*. (2008)].

#IE *Hake, R.R. 1998a. "Interactive-engagement vs traditional methods: A six thousand- student survey of mechanics test data for introductory physics courses," *Am. J. Phys.* **66**(1): 64-74; online at < http://tinyurl.com/3xuyqe > (84 kB).

#IE *Hake, R.R. 1998b. "Interactive- engagement methods in introductory mechanics courses," online at < http://tinyurl.com/2tg5d9 > (108 kB) - a crucial companion paper to Hake (1998a).

#IE Hake, R.R. 2000a. "What Can We Learn from the Physics Education Reform Effort?" ASME Mechanical Engineering Education Conference: *Drivers and Strategies of Major Program Change*, Fort Lauderdale, Florida, March 26-29; online at < http://www.physics.indiana.edu/~hake/ASME-040300e.pdf > (436 kB); especially Section IC, p. 7, Silvia Plath in *The Bell Jar* (Harper & Row, 1971), p. 28-29 wrote (our *italics*):

> *"The day I went into physics class was death* ….A short dark man .....(held)... a little wooden ball. He put the ball on a steep grooved slide and let it run down to the bottom. Then he started talking about let *a* equal acceleration and let *t* equal time. And suddenly he was scribbling letters and numbers and equals signs all over the blackboard and my mind went dead. …..Well, I studied those formulas, I went to class and watched balls roll down slides and listened to bells ring and by the end of the semester most of the other girls had failed and I had a straight A….but I was panic-struck. Physics made me sick the whole time I learned it. *What I couldn't stand was this shrinking everything into letters and numbers*."

#IPCS *Hake, R.R. 2000b. "Is it Finally Time to Implement Curriculum S?" *AAPT Announcer* **30**(4): 103; online at < http://www.physics.indiana.edu/~hake/CurrS-031501.pdf > (1.2 MB) – 400 references & footnotes, 390 hot-linked URL's.

> This paper concerns improving the education of undergraduate physics majors by instituting a "Curriculum S" for "Synthesis." But because that's a small part of a much larger educational problem in the U.S. there's a lot of material on the reform of P-16 education generally (P = preschool). A large number of references relevant to the reform of K-16 education is given on pages 55-99.

#LPE *Hake, R.R. 2000c. "The General Population's Ignorance of Science Related Societal Issues: A Challenge for the University," *AAPT Announcer* **30**(2): 105; online at < http://www.physics.indiana.edu/~hake/GuelphSocietyG.pdf > (2.1 MB).

> Based on an earlier libretto with the leitmotiv: "The road to U.S. science literacy begins with effective university science courses for pre-college teachers." The opera dramatizes the fact that the failure of universities *throughout the universe* to properly educate pre-college teachers is responsible for our failure to observe any signs of extraterrestrial (and even terrestrial) intelligence.

#CE *Hake, R.R. 2001. "Re: Mathematics and Constructivism," online at < http://mathforum.org/kb/thread.jspa?threadID=484332&tstart=4485 >. Post of 9 Dec 2001 22:01:00-0800 to Dewey-L, Math-Teach, and PhysLrnR.

#IE *Hake, R.R. 2002a. "Lessons from the physics education reform effort," *Ecology and Society* **5**(2): 28; online at < http://www.ecologyandsociety.org/vol5/iss2/art28/ >. *Ecology and Society* (formerly *Conservation Ecology*) is a free online "peer-reviewed journal of integrative science and fundamental policy research with about 11,000 subscribers in about 108 countries." For an update on six of the lessons on "interactive engagement" see Hake (2007e).

#SV #IE Hake, R.R. 2002b. "Relationship of Individual Student Normalized Learning Gains in Mechanics with Gender, High-School Physics, and Pretest Scores on Mathematics and Spatial Visualization," submitted to the Physics Education Research Conference; Boise, Idaho; August 2002; online at
< http://www.physics.indiana.edu/~hake/PERC2002h-Hake.pdf > (220 kB).

I found a gender-difference effect size for average normalized gains <g> of 0.58 for an introductory mechanics course IU95S. Meltzer (2002) calculated gender-difference effect sizes of 0.44 and 0.59 for two classes [N = 59, 78] at Iowa State University, but observed no significant gender difference in two other classes [N = 45, 37] at Southeastern Louisiana University. . . . *the <g> dependence on the gender 'hidden variable' is small relative to the very strong dependence of <g> on the degree of interactive engagement (effect size 2.43).* . . " Therefore, in my opinion, ***efforts to move traditional instruction more towards the interactive engagement for ALL students should receive a higher priority than concern for the apparently relatively small gender differences in test results discussed*** by McCullough (2001) and McCullough & Meltzer (2001).

Hake, R.R. 2002c. "What motivates H.S. girls to take physical sciences?" Part 1 online at
< https://carnot.physics.buffalo.edu/archives/2003/04_2003/msg00131.html >, Part 2 online at
< https://carnot.physics.buffalo.edu/archives/2003/04_2003/msg00132.html >. Posts of 13 Apr 2003 to AP-Physics, Physhare, Phys-L, and PhysLrnR.

*Hake, R.R. 2002d. "Physics First: Precursor to Science/Math Literacy for All?" *APS Forum on Education Newsletter*, Summer 2002; online at
< http://www.aps.org/units/fed/newsletters/summer2002/index.html >.

*Hake, R.R. 2002e. "Physics First: Opening Battle in the War on Science/Math Illiteracy?" Submitted to the *American Journal of Physics* on 27 June 2002; online at
< http://www.physics.indiana.edu/~hake/PhysFirst-AJP-6.pdf > (220 kB).

*Hake, R.R. 2003. "Can Mathematicians Learn Anything from Physics/Astronomy Education Research?" post of 3 Sep 2003 to POD and other discussion lists; online at
< http://tinyurl.com/5bys7e >: RRH wrote:

"In my opinion, Izsak's (2003) paper [that displays an awareness of physics education research] can only be explained in terms of quantum-mechanical tunneling through an otherwise impenetrable communications gap between math and physics education."

*Hake, R.R. 2004. "The Arons Advocated Method," submitted to *Am. J. Phys*. on 24 April 2004; online as reference 31 at
< http://www.physics.indiana.edu/~hake >, or download directly as a 144 kB pdf by clicking on
< http://www.physics.indiana.edu/~hake/AronsAdvMeth-8.pdf >.

Hake, R.R. 2005a. "Re: Physics Performance of All Female vs Mixed-Gender Groups," online at
< https://carnot.physics.buffalo.edu/archives/2005/07_2005/msg00136.html >
Post of 10 Jul 2005 15:32:42-0700 to AP-Physics, Phys-L, PhysLrnR, and Physhare.

#IE *Hake, R. R. 2005b. "The Physics Education Reform Effort: A Possible Model for Higher Education?" online at < http://www.physics.indiana.edu/~hake/NTLF42.pdf > (100 kB).

This is a slightly edited version of an article that was (a) published in the *National Teaching and Learning Forum* 15(1), December, online to subscribers at < http://www.ntlf.com/FTPSite/issues/v15n1/physics.htm >, and (b) disseminated by the *Tomorrow's Professor* list < http://ctl.stanford.edu/Tomprof/postings.html > as Msg. 698 on 14 Feb 2006. For an executive summary see Hake (2006b).

*Hake, R. R. 2005c. "Do Psychologists Research the Effectiveness of Their Courses? Hake Responds to Sternberg," online at < http://listserv.nd.edu/cgi-bin/wa?A2=ind0507&L=pod&P=R11939&I=-3 > .

Hake, R.R. 2006a. "Proof and Prejudice: Women in Mathematics and Physics," online at < http://tinyurl.com/6gsyzt >. Post of 23 & 24 Apr 2006 to AERA-A, AERA-B, AERA-C, AERA-D, AERA-J, AERA-K, AERA-L, ASSESS, EvalTalk, Math-Learn, Phys-L, PhysLrnR, POD, PsychTeacher (rejected), RUME, STLHE-L, TeachingEdPsych, & TIPS.

A commentary on *Tomorrow's Professor*, Message #717, "Proof and Prejudice: Women in Mathematics" [Reis (2006)]. The latter features "Biases must be tackled to achieve gender equity in mathematics, scholars argue" [Trie (2006)].

For a guide to discussion lists see "Over Sixty Academic Discussion Lists: List Addresses and URL's for Archives & Search Engines" [Hake (2007d)].

#IE *Hake, R.R. 2006b. "A Possible Model For Higher Education: The Physics Reform Effort (Author's Executive Summary)," *Spark* (American Astronomical Society Newsletter), June, online at < http://www.aas.org/education/spark/SPARK_2006_06_June.pdf > (1.9MB). Scroll down to pages 10 & 11 of the newsletter.

#EB *Hake, R.R. 2006c. "Can Neuroscience Benefit Classroom Instruction?" online at < http://listserv.nd.edu/cgi-bin/wa?A2=ind0610&L=pod&P=R6888&I=-3 >. Post of 12 Oct 2006 to POD and other discussion lists.

Abstract: I contrast the opinions of Judith Willis (2006) and John Bruer (1997) on the potential benefit of neuroscience to education. Willis' positive stance is moderated by her admission that neuroscience as applied to education has not been firmly validated. Bruer's negative stance is moderated by his belief that "eventually we will be able to bridge neuroscience at its various levels of analysis with education, but . . . all of these bridges will have a least one pier on the island of psychology."

For a recent review by cognitive scientists of the relevance of neuroscience to education see Varma *et al*. (2008)

#DM Hake, R.R. 2007a. "Re: Winnie and Math," online at < http://listserv.nd.edu/cgi-bin/wa?A2=ind0708&L=pod&P=R14667&I=-3 >. Post of 15 August to POD and other discussion lists:

Abstract: Hollywood actress Danica McKellar graduated summa cum laude from UCLA with a degree in math and coauthored the "Chayes-McKellar-Winn Theorem" on "Percolation and Gibbs state multiplicity for ferromagnetic Ashkin-Teller model on Z2." McKellar has been quoted thusly: "Nobody out there is saying that smart is sexy and smart is important. Role models like Paris Hilton have everything to do with why this country is being dumbed down. We need better PR." To that end McKellar has authored a book *Math Doesn't Suck: How to Survive Middle-School Math Without Losing Your Mind or Breaking a Nail*. But the book might better have been aimed at college graduates. Stanford's Jo Boaler – see Trie (2006) - has stated that girls and boys achieve at similar levels in mathematics through school and at the undergraduate level, but after college the numbers drop off. According to Stanford's Londa Schiebinger – see Trie (2006) - women earn 46 percent of undergraduate math degrees in this country but represent only 8 percent of math professors [Schiebinger may have meant math *full* professors – see Hale (2006)].

#DM Hake, R.R. 2007b. "Re: Winnie and Math: Girls' Math Scores Begin to Drop in Middle School?" online a < http://listserv.nd.edu/cgi-bin/wa?A2=ind0708&L=pod&P=R17025&I=-3 >. Post of 19 Aug 2007 to POD and other discussion lists.

Responds to a post by Cathy Kessel (2007), President of the Association for Women in Mathematics < http://www.awm-math.org/ >, who quotes data from National Assessment of Educational Progress and NCLB-induced data from California to dispute the advertisements for McKellar's (2007) book that "research continues to prove that it is in middle school when math scores begin to drop—especially for girls."

Hake, R.R. 2007c. "Re: Women in physics," online at < http://listserv.nd.edu/cgi-bin/wa?A2=ind0708&L=pod&P=R16476&I=-3 >. Post of 18-19 August 2007 to POD and other discussion lists. The abstract reads:

Rachel Ivie (2007), in a recent article "Deconstructing the 'Leaky Pipeline"shows an interesting graph "Actual and Expected Percentage of Women and Men in Physics in the U.S. for 6 categories: high school students, Bachelor's degrees, PhD degrees, Assistant Professors, Associate Professors, and Full Professors." Two BIG LEAKS of women from the physics pipeline are apparent between (A) women high school students of physics (about 47%) and women Bachelor's degrees in physics (about 21%), and (B) women Ph.D.'s in physics (14%) and women full physics professors (6%). Fiona McDonnell's (2005) ethnographic research suggests that BIG LEAK A may be due to women's strong rejection of the practices and rituals associated with their high school physics course. This is consistent with the research of Lorenzo, Crouch, & Mazur (2002), indicating a reduction in the gender gap in conceptual understanding in an introductory university physics course by using interactive engagement pedagogy. Reduction in the flow of women out of the above two major physics pipeline leaks, A & B, would seem to be required if the American Physical Society's Committee on the Status of Women in Physics (CSWP) is to meet its laudable goal of doubling the number of women in physics over the next 15 years – see Hodapp (2007).

*Hake, R.R. 2007d. "Over Sixty Academic Discussion Lists: List Addresses and URL's for Archives & Search Engines," online at < http://www.physics.indiana.edu/~hake/ADL-L.pdf > (640 kB), or as ref. 49 at < http://www.physics.indiana.edu/~hake >.

#IE *Hake, R.R. 2007e. "Six Lessons From the Physics Education Reform Effort," *Latin American Journal of Physics Education* **1**(1), September; online at < http://journal.lapen.org.mx/sep07/HAKE%20Final.pdf > (124 kB).

#LPE #IE *Hake, R.R. 2007f. "Can Scientific Research Enhance the Art of Teaching?" invited talk, AAPT Greensboro meeting, 31 July, online at < http://www.physics.indiana.edu/~hake/Sci&Art3.pdf > (1.2 MB), and as ref. 50 at < http://www.physics.indiana.edu/~hake/ >.

#IE *Hake, R.R. 2007g. "A Conversation With Eric Mazur," AERA-L post of 23 Jul 2007 17:10:06-0700; online at < http://tinyurl.com/2zo3pz > :

Abstract: I discuss a recent New York Times report by Claudia Dreifus (2007) titled "A Conversation With Eric Mazur: Using the 'Beauties of Physics' to Conquer Science Illiteracy." During the conversation Mazur states: "I did what everyone else did: lectures. And the feedback was positive.. . . . when I gave them . . [the Halloun-Hestenes (HH) (1985a) concept-based exam]. . . about half had no clue as to what Newtonian mechanics were about." Mazur then shifted to "Peer Instruction," an interactive-engagement type of pedagogy that resulted in much larger pre-to-post test gains on the HH test. Are there valid and consistently reliable diagnostic tests of conceptual understanding in other disciplines (developed by experts in those disciplines), comparable to the HH test in physics, that might be used to gauge the need for, and the effects of, reform pedagogy? Yes, sources of references to high quality conceptual tests in Astronomy, Biology, Chemistry, Economics, Engineering, Geoscience, and Math are given for instructors who may wish to formatively assess the cognitive impact of their courses by means of pre/post testing.

#IE *Hake, R.R. 2007h. "Mary Burgan's Defense of Lecturing," AERA-L post of 16 Feb 2007 22:05:16-0800; online at < http://tinyurl.com/36rkjt >. A response to "In Defense of Lecturing" [Burgan (2006)] - excepts from Burgan (2006) follow "Burgan:" my responses (slightly edited) follow "Hake:"

> Burgan: Pinker (1997). . . [a more recent edition is Pinker (1999)]. . ., in *How the Mind Works* criticizes the constructivists whose philosophy he describes as "a mixture of Piaget's psychology with counterculture and postmodernist ideology."
>
> Hake: Pinker is evidently unaware of (a) the "Many Faces of Constructivism" [Phillips (1995)] and their relevance to mathematics education - see, e.g., "Re: Mathematics and Constructivism" [Hake (2001)]; and (b) the "knowledge based constructivism" of cognitive scientists Lauren Resnick and Megan Hall (1998).
>
> Burgan: In the constructivist model, [Pinker] says "Children must actively construct mathematical knowledge for themselves in a social enterprise driven by disagreements about the meanings of concepts. The teacher provides the materials and the social milieu but does not lecture or guide the discussion. Drill and practice, the routes to automaticity, are called 'mechanistic' and seen as detrimental to understanding" [Pinker (p. 341-342 in the 1997 edition)]. Pinker, on the other hand, *believes that concepts have to be laid out, explained, and expounded*. [Our *italics*.]
>
> Hake: Pinker's "constructivist model" is a straw man which, as far as we know, is not commonly found in classrooms and is not generally advocated by the math education community: e.g., Forman & Pufall (1988); diSessa (1988); Lochhead (1988); Hiebert (1990); Schoenfeld (1992); Schoenfeld *et al*. (1998); NCTM (2000, 2006); Kilpatrick *et al*. (2001); Cohen & Ball (2001); Ball & Bass (2003); Izsak (2003); Hegedus & Kaput (2004); Ball *et al*. (2005); Bass (2005); Boaler (2008); Boaler & Staples (2008); USDE (2008). As for science education, perhaps Pinker could tell us how to "lay out, explain, and expound" the concepts of Newtonian mechanics so that students would demonstrate normalized pre-to-post test conceptual leaning gains comparable to those achieved by students benefiting from constructivist-type "interactive engagement."

#EB *Hake, R.R. 2007i. "Are Concepts Instantiated in Brain Synapses?" online at < http://listserv.nd.edu/cgi-bin/wa?A2=ind0706&L=pod&P=R10342&I=-3 >. Post of 17 Jun 2007 to POD and other discussion lists.

EB #IE *Hake, R.R. 2007j. "Should We Measure Change? Yes!" online at < http://www.physics.indiana.edu/~hake/MeasChangeS.pdf > (2.5 MB), or as ref. 43 at < http://www.physics.indiana.edu/~hake >. To appear as a chapter in *Evaluation of Teaching and Student Learning in Higher Education*, a Monograph of the American Evaluation Association < http://www.eval.org/ >. Therein I wrote (slightly edited):

"The Brain . . . Use It or Lose It. . . no matter what form enrichment takes, it is the challenge to the nerve cells that is important. Data indicate that passive observation is not enough; one must interact with the environment." [Marian Diamond (1996)]. *The superiority of IE methods in promoting conceptual understanding and higher-order learning is probably related to the "enhanced synapse addition and modification" induced by those methods*.

Cognitive scientists Bransford et al. (1999, 2000) stated: ". . . synapse addition and modification are lifelong processes, driven by experience. In essence, the quality of information to which one is exposed and the amount of information one acquires is reflected throughout life in the structure of the brain. This process is probably not the only way that information is stored in the brain, but it is a very important way that provides insight into how people learn."

Consistent with the above, the late biologist Robert Leamnson (1999, 2000) has stressed the relationship of biological brain change to student learning. In his first chapter "Thinking About Thinking and Thinking About Teaching," Leamnson (1999) defines teaching and learning thusly [our *italics*]

". . . teaching means any activity that has the conscious intention of, and potential for, *facilitation of* learning in another. . . . *learning is defined as stabilizing, through repeated use, certain appropriate and desirable synapses in the brain*. . . ."

And biologist James Zull (2003) in "What is The Art of Changing the Brain?" wrote [our *italics*]

"Although the human brain is immensely complicated, we have known for some time that it carries out four basic functions: getting information (sensory cortex,) making meaning of information (back integrative cortex), creating new ideas from these meanings (front integrative cortex,) and acting on those ideas (motor cortex).). . . [for Zull's schematic of the brain see < http://www.case.edu/artsci/biol/people/zull.html >]. . .. . From this I propose that there are four pillars of human learning: gathering, analyzing, creating, and acting. This isn't new, but its match the structure of the brain seems not to have been noticed in the past. *So I suggest that if we ask our students to do these four things, they will have a chance to use their whole brain*."

For pro and con articles on the relevance of neuroscience to present-day classroom instruction see e.g., PRO: Lawson (2006) and Willis (2006); CON: Marchese (2002) and Bruer (1997, 2006). See also the commentary on Willis (2006) and Bruer (2006) by Hake (2006c) and Redish (2006).

*Hake, R.R. 2007k. "Re: Natl Academies book," PhysLrnR post of 8 Jun 2007 17:45:08-0700; online at < http://tinyurl.com/69xhdr > - some minor criticism of Duschl et al. (2007).

To access the archives of PhysLnR one needs to subscribe, but that takes only a few minutes by clicking on < http://listserv.boisestate.edu/archives/physlrnr.html > and then clicking on "Join or leave the list (or change settings)." If you're busy, then subscribe using the "NOMAIL" option under "Miscellaneous." Then, as a subscriber, you may access the archives and/or post messages at any time, while receiving NO MAIL from the list!

*Hake, R.R. 2007l. Pre/post Tests For College Biology," online at < http://tinyurl.com/6f4k9c >. Post of 8 Sep 2007 22:01:17-0700 to AP-Bio, Biopi-L, Biolab (rejected), PhysLrnR, & STLHE-L.

*Hake, R.R. 2007m. "Pre/post Tests For College Chemistry," online at < http://tinyurl.com/5849w8 >. Post of 9 Sep 2007 18:59:09-0700 to AERA-C, AERA-J, AERA-L, AERA-C, AP-Chem, PhysLrnR, & STLHE-L.

#IE *Hake, R.R. 2008a. "Design-Based Research in Physics Education Research: A Review," in *Handbook of Design Research Methods in Education: Innovations in Science, Technology, Engineering, and Mathematics Learning and Teaching* [Kelly, Lesh, & Baek (2008)] – publisher's information at < http://tinyurl.com/4eazqs >; a pre-publication version of Hake's chapter is online at < http://www.physics.indiana.edu/~hake/DBR-Physics3.pdf > (1.1 MB).

#IE *Hake, R.R. 2008b. "Can Distance and Classroom Learning Be Increased?" *IJ-SoTL* **2**(1): January; online at < http://tinyurl.com/2t5sro >.

The *International Journal of Scholarship of Teaching and Learning* (IJ-SoTL) < http://www.georgiasouthern.edu/ijsotl/ > is an open, peer reviewed, international electronic journal containing articles, essays, and discussions about the scholarship of teaching and learning (SoTL) and its applications in higher/tertiary education today.

#IE #CE *Hake, R.R. 2008c. "Language Ambiguities in the Learning Sciences," submitted to the *Journal the Learning Sciences* on 4 March; online at <http://www.physics.indiana.edu/~hake/LangAmbiguitiesC.pdf> (2.1 MB) and as ref. 54 at <http://www.physics.indiana.edu/~hake>.

Contains a critique of "Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching" [Kirchner *et al*. (2006)].

#CE *Hake, R.R. 2008d. "Re: Constructivism in the APB classroom," online at < http://tinyurl.com/3nez7v >. Post of 4 Mar 2008 15:08:48 -0700 to AP-Physics, AERA-K, Physhare, & PhysLrnR.

#IE *Hake, R.R. 2008e. "Re: Science education reform references?," online at < http://tinyurl.com/4pvqqc >. Post of 19 Jun 2008 15:20:21-0700 to AERA-J, AERA-L, Net-Gold, PhysLrnR, and POD.

ABSTRACT: Patti Thorn wrote "I need assistance locating references that identify the current status of science education reform -- specifically, the extent to which instructional change that includes use of strategies to engage students actively in classroom learning -- is taking place." Successful implementation of interactive engagement methods has been reported at Harvard, North Carolina State, MIT, Univ. of Colorado, and California Polytechnic at San Luis Obispo. Nevertheless, only a tiny fraction of introductory physics courses (and probably an even tinier fraction of other university introductory courses) appear to have departed from the traditional passive-student lecture mode, as bemoaned by University leaders such as Derek Bok, James Duderstadt, and Richard Cyert. Research on innovation diffusion (or lack thereof) of the type pioneered by Everett Rogers and Clayton Christensen, and now being undertaken in physics by Henderson & Dancy, might yield more information on the factors responsible for the pathologically slow diffusion of innovation in higher education.

For a compilation of responses to Thorn's post see "Summary of responses to locate science education reform references?" [Thorn (2008)].

*Hake, R.R. 2008f. "Formative Pre/post Tests For Various Disciplines," online on the open AERA-D archives at < http://tinyurl.com/5o2ulg >. Post of 7 July to AERA-D and vaious other discussion lists. The abstract reads:

"I give references to: (I) well-known early concept inventories; (II) formative pre/post diagnostic tests for Astronomy, Economics, Biology, Biomechanics, Calculus, Chemistry, Geoscience, Statistics, Statics, and Engineering (Circuits, Computer Engineering, Dynamics, Electromagnetics, Electronics, Fluid Mechanics, Heat Transfer, Materials, Signals and Systems, Strength of Materials, Thermodynamics, and Waves); and (III) seven reviews that discuss pre/post testing."

Hale, P. 2006. "Proof and Prejudice: Women in Mathematics and Physics & Simpsons," RUME post of 26 April, online at < http://tinyurl.com/42uabn >. Hale wrote [our insert at ". . . .[insert]. . . ."]:

"Another possibility is that she. . . .[Londa Schiebinger as quoted by Trie (2006): "According to Schiebinger, women earn 46 percent of undergraduate math degrees in this country but represent only 8 percent of math professors"]. . . ... simply meant only 8% of full professors. The AMS data for 2004 indicates that 16% of tenured faculty are women (combining Groups I, II, III, Va, M & B). I am pretty sure the percentage for full professors is lower than the percentage for Associate and Full combined."

*Halloun, I. & D. Hestenes. 1985a. "The initial knowledge state of college physics students." *Am. J. Phys.* **53**: 1043-1055; online at < http://modeling.asu.edu/R&E/Research.html >. The print version contains the *Mechanics Diagnostic* test, precursor to the widely used *Force Concept Inventory* [Hestenes *et al.* (1992)]

*Halloun, I. & D. Hestenes. 1985b. "Common sense concepts about motion," *Am. J. Phys.* **53**: 1056-1065; online at < http://modeling.asu.edu/R&E/Research.html >.

#SDMA Halpern, D. 2000. *Sex Differences in Cognitive Ability*. Lawrence Erlbaum; 3rd edition. Amazon.com information at < http://tinyurl.com/6s4shd >. Note the "Look Inside" feature.

In the introduction Halpern writes: "The focus of the sex difference questions needs to change from 'Who is better?' to 'Where and when are meaningful differences found?' " For another excerpt from Halpern's introduction see the reference to Pinker & Spelke (2005).

A Google "book preview" is online at < http://tinyurl.com/6s4wr7 >. A search for "Benbow" discloses the following excerpt on page 115:

"Johns Hopkins University has been involved in a nationwide talent search to identify boys and girls who are exceptionally talented in mathematics [Benbow (1988), Benbow & Stanley (1980, 1981, 1983)]. One of the findings is that that there are substantial sex differences in the number of girls and boys identified as 'mathematically precocious.' They reported that among seventh and eighth grade students identified as mathematically talented, the male-to-female ratios on the College Board's SAT-M were as follows: 2:1 at greater than 500, 5:1 at greater than 600, and 17:1 at greater than 700 [Stanley & Benbow (1982)]. Furthermore Benbow (1988) reported that this ratio has remained stable for more than 15 years. . . . .[our insert - the ratios have been "stable" in the sense that they have always been greater than two, but the magnitude has diminished with time from 13 in 1983 to 2.8 in 2005 - see e.g. AMW (2005), Linn (2007), Halpern *et al.* (2007a,b)]. . . .

This is a considerable sex difference that has generated heated controversy and has received extensive coverage in the popular press and nonprint media. The fact that these differences emerged from very large samples and have been replicated many times lends credibility to those results. Do these differences reflect actual ability differences, or are they artifacts of the way the students were selected identified? Benbow and Stanley (1981) believe that students were selected in an unbiased manner and that the large sex differences are attributable, at least in part, to biological mechanisms, whereas the detractors argue that girls will always be underrepresented in fields that are defined by society as masculine [e.g., Halpern (1988)]. These two possibilities are considered in the following chapters in this book."

[See Halpern (2000) for the above references: Stanley & Benbow (1982) and Halpern (1988).]

Diane Halpern < http://www.claremontmckenna.edu/academic/faculty/profile.asp?Fac=302 > is chair of the Department of Psychology, Claremont McKenna College, and past president of the American Psychological Association.

Halpern, D.F. & M.D. Hakel, eds. 2002. *Applying the Science of Learning to University Teaching and Beyond: New Directions for Teaching and Learning*. Jossey-Bass; Amazon.com information at < http://tinyurl.com/6mvomv >. Note the "Search Inside" feature. Halpern & Hakel (HH) write [our *italics*]:

". . . . *it would be difficult to design an educational model that is more at odds with current research on human cognition than the one used in most colleges and universities*. Few academics seem to practice what they study in their laboratories and preach in their research articles. . . .[our insert - by "academics" HH evidently mean something like "psychologists and cognitive scientists"]. . . . .In thinking about this contradiction, we asked outstanding researchers . . . .[our insert – mostly psychologists]. . . . who are deeply concerned about education to help us answer a basic question 'How can we apply and extend our knowledge of how people think, learn, and remember to improve postsecondary learning – wherever it occurs – in colleges and universities, trade and professional schools, on the job, and in the home?' The authors of the chapters in this volume address this question and make data-based recommendations for the application of laboratory findings to the messy real-world setting where adults learn."

Judging from the index, the authors of the chapters are either oblivious or dismissive of the successful applications of the science of learning to enhance undergraduate education in disciplines such as astronomy, economics, biology, chemistry, economics, geoscience, engineering, and physics – see e.g., "Do Psychologists Research the Effectiveness of Their Courses? Hake Responds to Sternberg" [Hake (2005c)]; and "Reintroducing the Intro Course" [Stokstad (2001)].

Halpern, D.F. 2004. "A cognitive-process taxonomy for sex differences in cognitive abilities," *Current Directions in Psychological Science* 13(4): 135-139; abstract online at < http://tinyurl.com/67mqqh >:

"Females and males show different average patterns of academic achievement and scores on cognitive ability tests. Females obtain higher grades in school, score much higher on tests of writing and content-area tests on which the questions are similar to material that was learned in school, attain a majority of college degrees, and are closing the gap in many careers that were traditionally male. By contrast, males score higher on standardized tests of mathematics and science that are not directly tied to their school curriculum, show a large advantage on visuospatial tests (especially those that involve judgments of velocity and navigation through three-dimensional space), and are much more knowledgeable about geography and politics. A cognitive-process taxonomy can shed light on these differences."

Halpern, D.F. 2006. "Science, Sex, and Good Sense: Why Women are Underrepresented in Some Areas of Science and Math," in Ceci & Williams (2006). See also "Family-Work Issues for Women Scientists: An Interview with Diane F. Halpern" [Hoopes (2007)].

#SDMA Halpern, D.F., C.P. Benbow, D.C. Geary, R. Gur, J.S. Hyde, & M.A. Gernsbacher. 2007a. "The science of sex differences in science and mathematics," *Psychological Science in the Public Interest* **8***:* 1-51; contains a large set of references; online at < http://www.vanderbilt.edu/Peabody/SMPY/ScienceSexDifferences.pdf > (880 kB). Their summary concludes:

> "A wide range of sociocultural forces contribute to sex differences in mathematics and science achievement and ability—including the effects of family, neighborhood, peer, and school influences; training and experience; and cultural practices. We conclude that early experience, biological factors, educational policy, and cultural context affect the number of women and men who pursue advanced study in science and math and that these effects add and interact in complex ways. There are no single or simple answers to the complex questions about sex differences in science and mathematics."

Halpern *et al*. also wrote:

> "Stanley, who studied mathematically precocious youth for decades, explained that 25 years ago there were 13 boys for every girl who scored above 700 on the SAT-M at age 13. Now the ratio is only 2.8:1, which is a precipitous drop that has not been widely reported in the news media. According to Stanley, 'It's gone way down as women have had the opportunity to take their math earlier' (quoted in Monastersky (2005). There are no studies exploring the reasons for the decline, although possible reasons include that fact that high-school mathematics coursework for boys and girls has become more similar and more girls are getting more encouragement in the form of special programs and mentoring to encourage their participation in higher-level math courses. Regardless, these results suggest that the male advantage for mathematical skills may be limited to the upper end of the ability distribution."

#SDMA Halpern, D.F., C.P. Benbow, D.C. Geary, R. Gur, J.S. Hyde, & M.A. Gernsbacher. 2007b. "Sex, Math and Scientific Achievement: Why do men dominate the fields of science, engineering and mathematics?" *Scientific American*, November; online at < http://www.sciam.com/article.cfm?id=sex-math-and-scientific-achievement >. The key concepts are listed as :

> "Women, on average, have stronger verbal skills (especially in writing) and better memory for events, words, objects, faces and activities.
>
> Men generally are better at mentally manipulating objects and at performing certain quantitative tasks that rely on visual representations.
>
> *Intervention studies are still in their infancy but suggest both sexes can benefit from targeted training to improve their skill set*." [Our *italics*.]

Regarding Benbow & Stanley (1980) and its sequels, Halpern *et al*. wrote:

> "Although it has drawn little media coverage, dramatic changes have been occurring among these junior math wizards: the relative number of girls among them has been soaring. The ratio of boys to girls, first observed at 13 to 1 in the 1980s, has been dropping steadily and is now only about 3 to 1. During the same period the number of women in a few other scientific fields has surged. In the U.S., women now make up half of new medical school graduates and 75 percent of recent veterinary school graduates. We cannot identify any single cause for the increase in the number of women entering these formerly male-dominated fields, because multiple changes have occurred in society over the past several decades."

*Handelsman, J., D. Ebert-May, R. Beichner, P. Bruns, A. Chang, R. DeHaan, J. Gentile, S. Lauffer, J. Stewart, S.M. Tilghman, W.B. Wood. 2004. "Scientific Teaching," *Science* **304** (23): 521-522, April; online at < http://web.mit.edu/jbelcher/www/TEALref/scientificteaching.pdf > (88KB).

Supporting online material is at < http://www.sciencemag.org/cgi/data/304/5670/521/DC1/1 >; unfortunately URL's are not given for all the online material.

Handelsman, J., N. Cantor, M. Carnes, D. Denton, E. Fine, B. Grosz, V. Hinshaw, C. Marrett, S. Rosser, D. Shalala, & J. Sheridan. 2005. "More Women in Science," *Science* **309**(5738): 1190-1191, online at < http://www.plantpath.wisc.edu/fac/joh/publications/science2005.pdf > (124 kB). Supporting online material at < http://www.plantpath.wisc.edu/fac/joh/publications/Sci2005Supplement.pdf > (64 KB).

Hanna, G., ed. 1996. *Towards Gender Equity in Mathematics Education: An ICMI Study*. Springer; publisher's information at < http://www.springer.com/education/mathematics+education/book/978-0-7923-3922-9 >;

ICMI = International Commission on Mathematics Education < http://www.mathunion.org/ICMI/ >.

#FSP Haraway, Donna. 2005. Homepage at UC- Santa Cruz, < http://feministstudies.ucsc.edu/facHaraway.html >.

#FSP Haraway, D. 1990. *Primate Visions: Gender, Race, and Nature in the World of Modern Science*. Routledge. Amazon.com information at < http://tinyurl.com/43gvyp >.

#FSP Haraway, D. 1991. *Simians, Cyborgs, and Women: The Reinvention of Nature*. Routledge. Amazon.com information at < http://tinyurl.com/4mdkky >. Note the "Search Inside" feature.

#FSP Harding, S. 1986. *The Science Question in Feminism*. Cornell University Press. Amazon.com information at < http://tinyurl.com/3e5k9s >. Note the "Search Inside" feature.

For comments on Harding's standpoints see e.g., *Science and Anti-Science* [Holton (1993)], *A House Built on Sand: Exposing Postmodern Myths About Science* [Koertge (1998)], and *What Makes Nature Tick?* [Newton (1997)].

#FSP Harding, S. 1992. "Why Physics Is a Bad Model of Physics," in R.Q. Elvee, ed., *The End of Science? Attack and Defense*. University Press of America, publisher's information at < http://www.univpress.com/Catalog/Flyer2.shtml?SKU=0819184896 >. See comments by Holton (1993). Amazon.com information at < http://tinyurl.com/yswbrc > :

Book Description: The title "The End of Science?" asks not whether science itself is about to end or even to wane, but whether people will stop claiming that science knows nature as it is. Science, it suggests, may know nature only as the scientist sees it. Or the title suggests that, in knowing nature, scientists to some extent create nature. No one bothers to ask philosophers or theologians, poets, or politicians, workers or bosses whether they know the world as it is. It is common knowledge that the world for which they speak has been affected already by their description of that world. Will not the same fate strike scientists now? Has it not already? This is the basic issue that the six distinguished contributors address. They include Sandra Harding, Sheldon Lee Glashow, Ian Hacking, Mary Hesse, Gerald Holton, and Gunther S. Stent. Co-published with the Nobel Conference.

#FSP Harding, Sandra. 2008. Homepage at New York University, < http://www.gseis.ucla.edu/faculty/members/harding >.

#FSP Harding, S. 1998. *Is Science Multicultural? Postcolonialisms, Feminisms, and Epistemologies*. Indiana University Press, publishers information at < https://www.iupress.indiana.edu/catalog/product_info.php?isbn=0-253-21156-5 >. According to Indiana University Press:

"Noted theorist Sandra Harding explores what practitioners of European/American, feminist, and postcolonial science and technology studies can learn from each other. All three provide accounts of the history and practice of sciences which are alternative to the standard account of the Enlightenment Dream. These accounts require radical revision in conventional philosophies of science."

The first chapter is online at < http://www.havenscenter.org/files/Harding_3.pdf > (1.3 MB).

Harvey, J.D. 1997. *Almost a Man of Genius: Clemence Royer, Feminism, and Nineteenth-Century Science*. Rutgers University Press. Amazon.com information at < http://tinyurl.com/2a5omx >. Note the "Search Inside" feature.

Hassan, F. 2001. "Islamic Women in Science," *Science* **290** (5489): 55-56, 6 October, online at < http://www.sciencemag.org/cgi/content/full/290/5489/55 >.

*Hechinger, J. 2008. "Education Panel Lays Out Truce in Math Wars: Effort to Fix 'Broken' System Sets Targets for Each Grade, Avoids Taking Sides on Method" *Wall Street Journal*, 5 March; online at < http://tinyurl.com/3felhz >.

#SDMA Hedges, L.V. and A. Nowell. 1995. "Sex differences in mental test scores, variability, and numbers of high-scoring individuals," *Science* **269**(5220): 41-45; abstract online at < http://www.sciencemag.org/cgi/content/abstract/269/5220/41 >. Hedges & Nowell wrote:

> "Sex differences in central tendency, variability, and numbers of high scores on mental tests have been extensively studied. Research has not always seemed to yield consistent results, partly because most studies have not used representative samples of national populations. An analysis of mental test scores from six studies that used national probability samples provided evidence that although average sex differences have been generally small and stable over time, the test scores of males consistently have larger variance. Except in tests of reading comprehension, perceptual speed, and associative memory, males typically outnumber females substantially among high-scoring individuals."

#CE *Hegedus, S.J. & J.J. Kaput. 2004. "An Introduction to the Profound Potential of Connected Algebra Activities: Issues of Representation, Engagement and Pedagogy." *Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education* **3**: 129–136; online at < http://www.emis.de/proceedings/PME28/RR/RR261_Kaput.pdf > (408 kB).

*Heggen, J. 2008. "Report Critical of Math Teachers' Preparation," *Inside Higher Ed*, 30 June; online at < http://insidehighered.com/news/2008/06/30/math >. Heegen wrote:

> "At a time when many are bemoaning the lack of preparation of Americans in science and mathematics, a new study places at least some of the blame on math teachers left unequipped by college and university teacher education programs. A report . . . [NCTQ (2008]. . . . released Friday by the National Council on Teacher Quality looked at 77 elementary education programs from all states but Alaska, examining the math courses elementary teacher candidates had to take. The report looked at three factors: 'relevance,' the extent to which courses were relevant to what candidates would be teaching in the field; 'breadth,' the degree to which 'essential' topics are covered; and 'depth,' if enough time was given to these topics. Only 10 of the 77 programs scored adequately on all three criteria, according to the report. . . . . The study attributes the inadequacy to a combination of low expectations and standards, haphazard state guidance and an absence of national consensus about what math teachers should know, and the relative dearth of algebra instruction in many curriculums."

#EC Hewlett, S.A., C.B. Luce, L.J. Servon, L. Sherbin, P. Shiller, E. Sosnovich, & K.Sumberg. 2008. *"The Athena Factor: Reversing the Brain Drain in Science, Engineering and Technology*," *Harvard Business Review* Research Report, publisher's information at < http://app.post.hbsp.harvard.edu/athena/athena13/landingpage1.html >. Major points listed by the *Harvard Business Review* are:

a. 41% Science, Engineering, and Technology (SET) professionals are female at career lower-rungs,
b. 52% quit SET jobs, peaking at 10 year career mark,
c. 5 major factors contribute to mid-career SET female attrition,
d. 13 companies share initiatives designed to keep women on track with SET careers,
e. 25% reduction in female attrition adds 220,000 to qualified SET labor pool.

Center for Work-Life Policy < http://www.worklifepolicy.org/ > press release at < http://www.worklifepolicy.org/documents/AthenaPressRelease-April30.pdf > (40 kB) and abstract at < http://www.worklifepolicy.org/index.php/section/research_pubs >.

*Hiebert, J. 1990. "The role of routine procedures in the development of mathematical competence," in T.J. Cooney & C.R. Hirsch, eds., *Teaching and learning mathematics in the 1990s*; Yearbook of the National Council of Teachers of Mathematics, pp. 31-40. NCTM.

#SSIGD Hemel, D.J. 2005a. "Summers' Comments on Women and Science Draw Ire: Remarks at private conference stir criticism, media frenzy," *Harvard Crimson*, 14 January, online at < http://www.thecrimson.com/article.aspx?ref=505349 >. Hemel wrote:

> "Harvard President Lawrence H. Summers has triggered criticism by telling an economics conference Friday that the under-representation of female scientists at elite universities may stem in part from 'innate' differences between men and women, although two Harvard professors who heard the speech said the remarks have been taken out of context in an ensuing national media frenzy."
>
> Our thanks to Moira McDermott for this reference, given on her site < http://www.gustavus.edu/~mmcdermo/women-science-links.html > as "Summers' comments."

#SSGD #SDMA Hemel, D.J. 2005b. "Sociologist Cited By Summers Calls His Talk 'Uninformed' " *Harvard Crimson*, 19 January, online at < http://www.thecrimson.com/article.aspx?ref=505363 >. Hemel wrote:

> Two sociologists whose research University President Lawrence H. Summers cited at an economics conference Friday said yesterday their findings do not support Summers' suggestion that "innate differences" may account for the under-representation of women in the sciences.
>
> University of California-Davis sociologist Kimberlee A. Shauman said that Summers' remarks were "uninformed." The other researcher, University of Michigan sociologist Yu Xie, said he accepted Summers' comments as "scholarly propositions," although he said his own analysis "goes against Larry's suggestion that math ability is something innate."
>
> Xie and Shauman presented their findings at the National Bureau of Economic Research Friday afternoon, shortly after Summers' remarks.
>
> In an interview with The Crimson last night, Summers stressed that he only cited Xie and Shauman's research. . . . [our insert - see Xie & Shauman (2005)]. . . as evidence that females are underrepresented among the top 5 percent of test-takers on standardized assessments. *Summers said the evidence for his speculative hypothesis that biological differences may partially account for this gender gap comes instead from scholars cited in Johnstone Family Professor of Psychology Steven Pinker's bestselling* 2003 book *The Blank Slate: The Modern Denial of Human Nature*. . . . . [Our *italics*.] [Our insert – according to reference 20 of the background information for the AWM's (2005) petition "Concern regarding the inclusion of Dr. Camilla Benbow on the National Mathematics Advisory Panel," among the scholars cited by Pinker are Hedges and Nowell (1995) and Lubinski and Benbow (1992).]

Henrion, C. 1997. *Women in Mathematics: The Addition of Difference*. Indiana University Press, publisher's information at
< http://www.iupress.indiana.edu/catalog/product_info.php?products_id=21505 > :

"Mathematics is often described as the purest of the sciences, the least tainted by subjective or cultural influences. Theoretically, the only requirement for a life of mathematics is mathematical ability. And yet we see very few women mathematicians. Why? Based upon a series of ten intensive interviews with prominent women mathematicians throughout the United States, this book investigates the role of gender in the complex relationship between mathematician, the mathematical community, and mathematics itself."

Claudia Henrion is Visiting Professor of Mathematics, Education, and Women's Studies at Dartmouth College.

#EB *Hestenes, D. 1987a. "How the Brain Works: The next great scientific revolution," in C.R. Smith and G.J. Erickson, eds., *Maximum Entropy and Bayesian Spectral Analysis and Estimation Problems*. Reidel, Dordrecht/Boston, pp. 173-205. See Hestenes (1987b) for a discussion of this essay.

#EB *Hestenes, D. 1987b. "Toward a modeling theory of physics instruction," *Am. J. Physics*. **55**(5): 440-454, online at < http://modeling.la.asu.edu/R&E/Research.html > and, for subscribers < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=55&Issue=5 >.

*Hestenes, D., M. Wells, & G. Swackhamer. 1992. "Force Concept Inventory," *Phys. Teach*. **30**(3): 141-158, March; online (except for the test itself) at
< http://modeling.asu.edu/R&E/Research.html >.

The 1995 revision by Halloun, Hake, Mosca, & Hestenes is online (password protected) at the same URL, and is currently available in 15 languages: Chinese, Czech, English, Finnish, German, Greek, Italian, Malaysian, Persian, Portuguese, Russian, Slovak, Spanish, Swedish, & Turkish. A French version should soon be available.

#EB Hines, M. 2004. *Brain Gender*. Oxford University Press, publisher's information at
< http://tinyurl.com/67soat >:

"This book brings a social developmental, as well as a biological and clinical psychological, perspective to bear on the factors that shape our development as male or female, and that cause individuals within each sex to differ from one another in sex-related behaviors. Topics covered include sexual orientation, childhood play, spatial, *mathematical and verbal abilities*, nurturance, aggression, dominance, handedness, *brain structure*, and gender identity. This original and accessible book is of interest to psychologists, neuroscientists, pediatricians, and educators, as well as the general public. It is also used in graduate and undergraduate courses on the psychology of gender and on hormones and behavior. . . . . Melissa Hines is a Professor of Psychology and Director, Behavioural Neuroendocrinology Research Unit, City University, London." [Our *italics*.]

Hines, M. 2006. "Can Science Include Women: To What Extent Can Sex Differences In Cognition Account For The Dearth Of Women In Science?" in Ceci & Williams (2006).

HIRA. 2008. Higher Education Research Institute, UCLA, online at
< http://www.gseis.ucla.edu/heri/index.php > :
Reinforcing Differences: College and the Gender Gap
< http://www.gseis.ucla.edu/heri/research.php >,
The Impact of Single-Gender High Schools on Students' Transition to College and First-Year Development < http://www.gseis.ucla.edu/heri/research.php >.

Hodapp, T. 2007. "A Meeting of Minds on Welcoming Women," *Interactions*, June/July, p. 29.
As far as we know there is, as yet, no online version of the new AAPT journal *Interactions*.
As discussed in "Re: Women in physics" [Hake (2007c)], Hodapp discusses a recent conference held by the APS's Committee on the Status of Women in Physics (CSWP) of department chairs, managers of national laboratories, and funding agencies, with an aim to further CSWP's long range goal of doubling the number of women in physics over the next 15 years. See e.g., "Gender Equity Conference: Strengthening the Physics Enterprise in Universities and National Laboratories" [APS (2007)] and "Gender Equity: No Silver Bullet but Lots of Ways to Help" [APS News (2007)]. Such doubling would seem to require reduction in the flow of women out of the above two major physics pipeline leaks. . . .[see Ivie (2007)]. . . . between: (A) high school physics and physics Bachelor's degrees and (B) Ph.D.'s in physics and full physics professors.

Hollenshead, C., P. Soellner-Younce, & S.A. Wenzel. 1994. "Women Graduate Students in Mathematics and Physics: Reflections Upon Success," *Journal of Women and Minorities in Science and Engineering* **1**(1).

*Holt, R. 2001. "Science Education is Not Just for Scientists" *APS News*, June: online (for APS members) at < http://www.aps.org/publications/apsnews/200106/backpage.cfm > : Holt wrote:
"Our country must devote attention to the quantity, quality, and professional work environment of our teachers. There are two very important, although often neglected, principles that are critical to the success in this effort: *Everyone can learn science. And excellent teaching can be learned*. (Our *italics*.) In the next ten years, we will have to hire 2.2 million teachers just to stay even with the attrition of our teaching force. Most of these teachers, including all elementary school teachers, will be called on to teach science. Many will feel inadequate to teach it. . . . Congresswoman Connie Morella and I have taken the Glenn Commission's recommendations and introduced legislation that seeks to make these changes. The National Improvement in Mathematics and Science Teaching Act (H.R. 117) would establish a new Title in the Elementary and Secondary Education Act to improve the quality of our math and science education."
Rush Holt (D-NJ) < http://holt.house.gov/ > represents the 12th Congressional district in New Jersey, a position to which he was first elected in 1998. He serves on Committee on Education and the Labor, the Committee on Natural Resources, and the House Permanent Select Committee on Intelligence, and is a Fellow of the APS.

#FSC Holton. G. 1993. *Science and Anti-Science*. Harvard University Press, publisher's information at < http://www.hup.harvard.edu/catalog/HOLSCI.html >. See especially Chapter 6: "The Anti-Science Phenomenon." Holton wrote:

> "A fourth group. . .(who oppose what they conceive of as a hegemony of science-as-done-today in our culture). . .is a radical wing of the movement represented by such writers as Sandra Harding who claims that physics today 'is a poor model [even] for physics itself' (Harding 1992). For her science now has the fatal flaw of 'androcentrism'; that, together with faith in the progressiveness of scientific rationality, as brought us to the point where, she writes: "a more radical intellectual, moral, social, and political revolution [is called for] than the founders of modern Western cultures could have imagined' (Harding 1986). One of her like-minded colleagues goes even further, into the fantasy that science is the projection of Oedipal obsessions with such notions as force, energy, power, or conflict."

Holton, G. 1999. "Different Perceptions of 'Good *Science'* and Their Effects on Careers," in Selby (1999), p. 79.

*Holton, G. 2001. "What is the Imperative for Basic Science that Serves National Needs?" *APS Forum on Physics & Society Newsletter*, Spring; online at < http://www.aps.org/units/fps/newsletters/2001/april/ap1.html >. Holton wrote:

> "Among the familiar research styles are two modes of basic research, well established and utterly needed to be adequately supported in the total range of efforts. One mode. . .(the 'Newtonian'. . .) is primarily curiosity-driven basic research, without the expectation of any but perhaps long-term social benefits, apart from the important one of increasing of scientific understanding itself. The other mode. . .(the 'Baconian') . . . is that part of R&D pursued in the reasonable hope that a fairly early harvest would result, for use and practice beyond the originating laboratory. . . Both must of course continue to flourish, not least because all modes interact. But research in the *Jeffersonian mode*, by contrast, places itself on an uncharted area on the map of science, which, if the expedition succeeds, *may reasonably soon have a bearing on a persistent national or global problem*. . . .[cf., Stokes (1997)]. . .
>
> It is in a sense a combined mode, and the label I chose for it reflects the fact that Thomas Jefferson himself saw two intertwined goals for science—not only the full understanding of nature, which he treasured, but in addition what he called simply 'the freedom and happiness of mankind.' *It is not difficult to imagine intentionally targeted basic science research projects where, with less uncertainty and less time delay than from Newtonian research, one can reasonably hope to find a key to alleviate specific, well recognized societal dysfunctions*. For example, much remains to be done in . . . . *research on the remaining social and psychological obstacles that still stand in the way of greater participation and diversity, not least in careers in science and technology*." (Our *italics*.)

Hoopes, L.L.M. 2007. "Family-Work Issues for Women Scientists: An Interview with Diane F. Halpern," *AWIS Magazine*, Summer, p.8; online at < http://www.awis.org/pubs/documents/Summer2007pdf_000.pdf > (4.2 MB).

#FSC Hornig, L. 1987. "Gender and science," *GASAT* 4 (1987). This paper, which challenged the then nascent claims from some feminists that science was intrinsically inappropriate for women, and that is why they avoided it, has been rarely cited. Hornig wrote:

> "…although it is true that the concentration of women in most science fields is below one-third, compared to about one-half in the humanities, the numbers of women scientists far exceed those of women humanists. Thus, among the total current stock of Ph.D.s in this country, there are about 63,000 women scientists and about 27,000 women humanists, or a ratio of 2.33. The ratio of new women Ph.D.s in sciences to those in humanities in 1985 stood at 3.44, so that the disparity is growing just as it has among men. The fields regarded as least congenial to women – physical and mathematical sciences—produced over 900 doctorates in 1985, contrasted with about 630 in the so-called traditional fields of English and other modern languages…. more women have been Nobel laureates in the sciences than in either literature or peace endeavors…. When we compare women to men, determining the relative proportions of each sex in various activities, we see great inequalities. When we compare women in one field to those in another, determining how they distribute themselves among the choices open to them, we discover two things: the patterns of choice resemble those of men, and the disadvantages women face are essentially invariant across fields. In short, women face some discrimination in all careers *because they are women*, not because they are unsuited to science or science to them." [*Italics* in the original.]

#FSC Howard, S. 2000. "Science Has No Gender," *STATUS*, January; online at < http://www.aas.org/cswa/status/status_jan00.pdf > (256 kB):

> "For over 4,000 years the historical record has, now and then, included scientists, engineers, and natural philosophers. For over 4,000 years there have been women in that list just as there have been men. Who would have thought it? It's true. Science is as traditional a role for women as it has been for men. . .. The people who can combine the sensible chunks into useful solutions are scientists and engineers. Scientists do tend to share certain attributes: luck, intelligence, education, ability, courage, and sweat. There is no gender lurking in these features. None. THE RESULTS OF SCIENCE HAVE NO GENDER. . . .With the help of Dr. Deborah Crocker at the University of Alabama we created a web page . . . (Astronomy Program. 2002). . . with all the details." (EMPHASIS in the original.)

#SV Howe, A.C. and W. Doody. 1989. "Spatial visualization and sex-related differences in science achievement." *Science Educ*. **73**: 703-709.

Huang, A.S. 2002. "Things Your Professor Should Have Told You," *STATUS,* January 2002; online at < http://www.aas.org/cswa/status/statusJan02c.pdf > (1.2 MB).

> From the forward by Catherine Pilachowski & Anneila Sargent: ". . .Alice Huang, former Dean of Science and Professor of Biology at New York University, and now Faculty Associate in Biology at Caltech, discusses strategies that can be effective in the professional arena. Most importantly, these are not confined to advice on coping with the workplace but describe how women who have achieved a degree of success in their careers can make enormous contributions to improving conditions for those who follow."

Huang, G., N. Taddese, & E. Walter. 2000. *Entry and persistence of women and minorities in college science and engineering education* (NCES Publication No. 2000-601). U.S. Department of Education. Office of Educational Research and Improvement; online at < http://nces.ed.gov/pubs2000/2000601.pdf > (388 kB).

Hufnagel, B. 2006. Review of *Beamtimes and Lifetimes: the World of High Energy Physicists* [Traweek (1988)], *STATUS*, Winter, online at
< http://www.aas.org/cswa/status/Status_Jan06.pdf > (1.1 MB).

Hult, C., R. Callister, & K. Sullivan. 2005. "Is There A Global Warming Toward Women In Academia?" *Liberal Education*, Summer/Fall, online at
< http://www.aacu.org/liberaleducation/le-sufa05/le-sufa05perspective.cfm >. Hult *et al.* wrote:

> "While global warming toward women in academia (in this case a desirable trend) may be occurring in some academic departments or institutions—most notably in community colleges—the same cannot be said for many colleges of Science, Engineering, and Technology (SET colleges). There, the climate for women is very chilly indeed. As Cathy Ann Trower reports in *Science* magazine (2001). . . . [our insert - Trower (2001; 2002a,b]. . . . ., 42 percent of full professors in two-year colleges are women; however, women comprise only 17 percent of the full professor ranks at doctoral-granting institutions. For SET colleges, the figures are even lower. 'In 4-year colleges and universities,' Trower reports, 'women SET (science, engineering and technology) faculty hold fewer high-ranking posts than men, are less likely to be full professors, and are more likely to be assistant professors.' "

*Hunt, L. A. Bromage, & B. Tomkinson, eds. 2006. *Realities of Educational Change: Interventions to Promote Learning and Teaching in Higher Education*. Routledge, publisher's information at < http://tinyurl.com/4dhw3r >. Amazon.com information at
< http://tinyurl.com/5zrwge >. Note the "Search Inside" feature.

Hyde, J.S. and M.C. Linn, eds. 1986. *The Psychology of Gender: Advances through Meta-analysis*. Johns Hopkins University Press. Amazon.com information at
< http://tinyurl.com/3rjvww >.

#SDMA Hyde, J.S., E. Fennema, & S. Lamon. 1990. "Gender differences in mathematics performance: A meta-analysis, *Psychological Bulletin* **107**: 139-155; online at
< http://www.plantpath.wisc.edu/CZA%20WS%20530/Hyde_et_al.'90.pdf >. The abstract concludes:

> "The magnitude of the gender difference has declined over the years; for studies published in 1973 or earlier d was 0.31, whereas it was 0.14 for studies published in 1974 or later. . . . .[our insert – evidently "d" is the "Cohen (1986) effect size"]. . . . We conclude that gender differences in mathematics performance are small. Nonetheless, the lower performance of women in problem solving that is evident in high school requires attention."

#SDMA Hyde, J. S. 2005. "The Gender Similarities Hypothesis," *American Psychologist* **60**(6): 581-592; online at < http://www.apa.org/journals/releases/amp606581.pdf >. For responses and a reply by Hyde see Davies & Shackelford (2006). The abstract of Hyde (2005) reads:

> "The differences model, which argues that males and female are vastly different psychologically, dominates the popular media. Here, the author advances a very different view, the gender similarities hypothesis, which holds that males and females are similar on most, but not all, psychological variables. Results from a review of 46 meta-analyses support the gender similarities hypothesis. Gender differences can vary substantially in magnitude at different ages and depend on the context in which measurement occurs. Over inflated claims of gender differences carry substantial costs in areas such as the workplace and relationships."

#SDMA Hyde, J.S. and M.C. Linn. 2006. "Gender Similarities in Mathematics and Science," *Science* **314** (5799): 599-600, 27 October 2006; summary online at < http://www.sciencemag.org/cgi/content/summary/314/5799/599 > :

"Boys and girls have similar psychological traits and cognitive abilities; thus, a focus on factors other than gender is needed to help girls persist in mathematical and scientific career tracks."

A response by Melvin Konner < http://www.anthropology.emory.edu/FACULTY/ANTMK/ > Professor of Anthropology and Associate Professor of Psychiatry and Neurology at Emory University, is at < http://www.sciencemag.org/cgi/eletters/314/5799/599#10140 >. Konner wrote:

"The article . . . . [Hyde & Linn (2006)]. . . makes one very important point but obscures another. The sex difference in mathematical ability is small or trivial when we consider means and effect sizes. When assessing applicants for a position requiring average, high, or perhaps even very high mathematical ability, we should expect equal or almost equal numbers of males and females. However, the article neglects the tails of the distribution. . . . . *The reality in mathematical ability, for example, is that male variance is higher, so that both tails extend beyond the female distribution*. . . . [Our *italics* - Konner echoes the standpoint of Benbow and colleagues.]. . . . . This fact lends a different interpretation of the similarities between the means and, more importantly, it suggests a predominance of males at the very top as well as at the bottom; both have been shown in many studies. For readers of *Science*, the very top is very important. Even for the Fields Medal, only the work, not the person, should matter, but the expectation of gender balance at this level is unfair and counterproductive. . . . . to obscure the very different situation at the tails of the distribution is not going to help us move forward."

Institute of Physics (British). 2008. "Women in Physics Group Home Page," online at < http://www.iop.org/activity/groups/professional/wip/index.html >.

InterAcademy Council. 2008. "*Women for Science*; online at < http://www.interacademycouncil.net/?id=11228 >:

Realizing that the low representation of women in science and engineering is a major hindrance to global capacity building in science and technology, the IAC formed an Advisory Panel on Women for science with the mandate to review previous studies, provide examples of effective projects already implemented, and issue a set of actionable recommendations addressed particularly to the world's science and engineering academies. The recommendations and action items developed through the work of this Panel are presented in this report and are grouped around three themes:

a. Academies advocating and promoting the education and careers of women;
b. Academies acting, both individually and jointly, to engage women in global capacity building;
c. Academies building inclusive institutional climates and advising governments and other principal players on specific actions toward similar ends.

The complete report is available on this site through the links below.

#LPE *Intergovernmental Panel on Climate Change (IPPC). 2008. Online at < http://www.ipcc.ch/ >; see especially IPCC Fourth Assessment Report, Working Group I Report "The Physical Science Basis" < http://www.ipcc.ch/ipccreports/ar4-wg1.htm >.

INWES. 2008. International Network of Women Engineers and Scientists. Online at < http://www.inwes.org/ > :

"INWES, the International Network of Women Engineers and Scientists, created the web site to share information, knowledge, and ideas that can provide a significant voice, for women around the world, a voice that is heard by mainstream mainstream science and engineering on issues such as the environment, sustainable development, gender equity, and many other critical issues. Another goal is to state clearly and consistently our position and views in a united effort."

INWES. 2008. Gender Equity Resources, online at < http://www.inwes.org/resources.asp >.

INWES 14. 2008. "A changing world: new opportunities for women engineers and scientists," July 15th to Friday 18th, 2008, in Lille, France; online at < http://www.icwes14.org/icwes14-en >. Accepted papers as of 16 April 2008 at < http://www.icwes14.org/offres/file_inline_src/152/152_A_2071_1.pdf > (40kB).

*Izsak, A. 2003. " 'We Want a Statement That Is Always True': Criteria for Good Algebraic Representations and the Development of Modeling Knowledge," *J. of Research in Mathematics Education* **34**(3): 191-227; NCTM members may download the entire article at < http://my.nctm.org/eresources/article_summary.asp?URI=JRME2003-05-191a&from=B >. Non-members have free access only to the abstract.

**Issues in Science and Technology*. 2008. A publication of National Academy of Sciences, National Academy of Engineering, Institute of Medicine, & University of Texas at Dallas. Free online to all at < http://www.issues.org/index.html >; archives at < http://www.issues.org/backissues.html >.

IUPAP. 2008. International Union of Pure and Applied Physics, WG5: Working Group on Women in Physics, online at < http://www.iupap.org/wg/wip/ >. Links to Conferences on Women in Physics:

First (Paris. 2002) < http://www.if.ufrgs.br/iupap/index-conference-2002.html >,
Second (Rio de Janeiro, 2005) < http://www.cbpf.br/~women-physics/ >, and
Third (Seoul, 8-10 October 2008) < http://www.icwip2008.org/ >.

Ivie, R. and K. Stowe. 2000. "Women in Physics, 2000," American Institute of Physics, online thanks to ERIC at < http://tinyurl.com/48cdzp > as a 480 kB pdf. Ivie and Stowe wrote:

"Although women now earn more than one half of all bachelor's degrees in the U.S., physics is not attracting women as quickly as other fields, including life sciences, chemistry, and engineering . . . Compared to other fields, women are sorely underrepresented in physics at both the bachelor's and PhD levels . . . . . Observers have offered various explanations for women's poor representation in physics. Many of the explanations do not hold up in light of available data. It is possible that women still experience subtle discrimination leading them away from physics and that women choose careers that are less clearly linked to physics."

Ivie, R., R. Czujko, & K. Stowe. 2001. "Women Physicists Speak: The 2001 International Study of Women in Physics," American Institute of Physics Report, Statistical Research Center, College Park, MD; online at < http://www.aip.org/statistics/trends/reports/iupap.pdf > (152 kB).

This is a follow up to a survey by R. Ivie, R. Czujko, K. Stowe, "Women Physicists Speak" in *Women in Physics: The IUPAP International Conference on Women in Physics,* edited by B. K. Hartline and D. Li, AIP Conference Proceedings 628, American Institute of Physics, Melville, NY, 2002, pp. 49-67.

Ivie, R. & K.N. Ray. 2005. "Women in Physics and Astronomy, 2005" online at < http://www.aip.org/statistics/trends/reports/women05.pdf > (264 kB).

For an earlier report see Ivie and Stowe (2000). For discussions of the Ivie/Ray report see AIP (2005, 2006) and Czujko & Ivie (2005).

Ivie, R. 2007. "Deconstructing the 'Leaky Pipeline': Gender discrimination may be a factor in explaining the absence of women physics faculty, but the numbers tell a different story," *Interactions*, June/July, pp. 24-25. As far as we know there is, as yet, no online version of the new AAPT journal *Interactions*. Ivie wrote:

"Compared to their representation in other fields, women are underrepresented in physics, especially at the top levels. In fact, the gap gets progressively wider at every rung up the academic ladder. . .[as is indicated by her graph]. . . . .For example, women accounted for 14% of all Ph.D.s earned in physics in 2005, but far fewer women - only six percent - were full professors of physics in 2006. This statistical phenomenon is known as the 'leaky pipeline,' reflecting as widely held belief that more women drop out of physics at every step along the educational path. In contrast to the prevailing view, however, data compiled by the American Institute of Physics (AIP) show that for women in physics, these leaks only occur at specific points along the path."

As discussed in "Re: Women in physics" [Hake (2007c)], Ivie's graph shows that in addition to the leak between physics Ph.D.'s and full physics professors, another prominent leak occurs between high school and university graduation: about 47% of high school physics students are women, but only about 21% of physics Bachelor's degrees are awarded to women.

Ivie, R. & K.N. Ray. 2005. "Women in physics and astronomy 2005," American Institute of Physics Report, Statistical Research Center, College Park, MD (AIP Publ. No. R-430.02), February; online at < http://www.aip.org/statistics/trends/reports/women05.pdf > (264 kB).

See also "Frequently Asked Questions" by Roman Czujko & Rachel Ivie, online at < http://www.aip.org/statistics/trends/reports/womenfaq.htm >.

Ivie, R. & S. Guo. 2006. "Women Physicists Speak Again," American Institute of Physics Report, Statistical Research Center, College Park, MD (AIP Pub. Number R-441), April; online at < http://www.aip.org/statistics/trends/reports/iupap05.pdf > (620 kB).

IWF. 2008. Independent Women's Forum, online at < http://www.iwf.org/ >. According to < http://en.wikipedia.org/wiki/Independent_Women's_Forum > :

"The Independent Women's Forum (IWF) is a non-profit, non-partisan research and educational institution focused on domestic and foreign policy issues of concern to women. The group promotes an equity feminist view < http://en.wikipedia.org/wiki/Equity_feminism > — called antifeminist by critics [Pozner (1997)]—that is contrary to what IWF National Advisory Board Chairman Christina Hoff Sommers (1995) describes as the more prevalent gender feminism [Conniff (1997)]. In keeping with the organization's slogan, which states that "All Issues are Women's Issues," IWF is an active participant in policy discussions not only about traditional women's issues like domestic violence, parental rights, property rights, and education, but also such topics as national defense, health care, and foreign policy."

Jackson, A. 2004. "Has the women-in-mathematics problem been solved?" Notices of the American Mathematical Society **51**(7): 776-783; online at < http://www.ams.org/notices/200407/comm-women.pdf > (160 kB).

#CS *Jasanoff, S., G.E. Markle, J.C. Peterson, & T. Pinch. 2001. *Handbook of Science and Technology Studies*. Sage, publisher's information at < http://www.sagepub.com/booksProdDesc.nav?contribId=502493&prodId=Book225385 > :

"This volume represents the social constructivist turn of the field. It is evident that social constructivism made a major impact on the field during the 1970s and 1980s. The diverse papers included here highlight the role of ethnography in STS. In addition, we are exposed to new perspectives of the multicultural and gendered nature of knowledge production." — *Science, Technology, and Society*

#SSIGD Jaschik, S. 2006. "Summers Postmortem, Beyond Cambridge," *Inside Higher Ed*, online at < http://insidehighered.com/news/2006/02/22/summers >.

*JCSEE. 1994. Joint Committee on Standards for Educational Evaluation, *The Program Evaluation Standards*, 2nd ed., Sage. A glossary of evaluation terms from this publication is online at < http://ec.wmich.edu/glossary/prog-glossary.htf >.

Johnson, S., P. Murphy, R. Driver, J. Head, and D. Palacio. 1983. "The science performance of boys and girls aged 11-15 [GASAT#2 (1983)] - see GASAT International (2008).

Jones, A. T. and C. M. Kirk. 1990. "Gender differences in students' interests in applications of school physics," *Physics Educ*. **25**(6): 308-313; abstract online at < http://www.iop.org/EJ/abstract/0031-9120/25/6/304 > :

"We examine the type of physics applications that students would be interested in learning more about at school, and explore the gender differences within that choice."

Jones, M. G. and J. Wheatley. 1988. "Factors influencing the entry of women into science and related fields," *Science Educ*. 72(2): 127-142; online to subscribers at < http://tinyurl.com/6ecpng >.

Jones, M. G. and J. Wheatley. 1990. "Gender differences in teacher-student interactions in science classrooms." *J. Res. Science Teaching* **27**(9): 861-874; online to subscribers at < http://www3.interscience.wiley.com/journal/112753112/issue >.

#IPCS *Jossem, E.L. 1964, "Undergraduate Curricula in Physics: A Report on the Princeton Conference on Curriculum S," *Am. J. Phys.* **32**(6): 491–497, online at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=32&Issue=6 > :

> Abstract: Starting with the recommendations of the Second Ann Arbor Conference on two distinct undergraduate physics major programs, R and S. . . .[our insert – "R" for Research and "S" for Synthesis]. . . , the Princeton Conference on Curriculum S continued the consideration of the conceptual and practical problem of providing appropriate instruction in physics to undergraduate majors having a variety of educational goals. Major discussion was concerned with the nature of Curriculum S and its relation to R, with the desirability of providing more open curricular structures, and with the problems of obtaining an optimum mixture of elements of analysis and synthesis in intellectually vigorous courses. Several sample skeleton outlines of possible curricula were produced by Conference working groups, and it is expected that progress in developing the working materials for the S curriculum will be continued.

Jossem, E.L. 2008. "Turning points in physics education: Arnold Arons, physicist and physics teacher, played a pivotal role in the postwar development of physics education," *Physics Today* 61(5): 72-73; online to subscribers at < http://ptonline.aip.org/journals/doc/PHTOAD-ft/vol_61/iss_5/72_1.shtml >. For another tribute to the late Arnold Arons see "The Arons Advocated Method" [Hake (2004)].

Journal of Women and Minorities in Science and Engineering. 2008. Online at < http://www.begellhouse.com/journals/00551c876cc2f027.html >. Lists Table of Contents for volumes 6(2000) – 13(2007):

> "Designed as a unique and much-needed resource for educators, managers, and policymakers, the *Journal of Women and Minorities in Science and Engineering* publishes original, peer-reviewed papers that report innovative ideas and programs for classroom teachers, scientific studies, and formulation of concepts related to the education, recruitment, and retention of under-represented groups in science and engineering. Discipline-specific issues related to women and minorities are consolidated to address the entire educational environment from K through post-graduate and on to continuing education. Included are explorations of feminist teaching methods, black student/white teacher interactions, cultural phenomena that affect classroom climate, and new questions to ask of science. The journal includes pertinent book reviews and 'reports from the field' by women and men of color in academe, business, industry, and federal and state agencies."

Kahle, J.B., ed. 1985. *Women in Science: A Report From the Field*. Falmer Press. Amazon.com information at < http://tinyurl.com/5ngvvm >.

Kahle, J.B. 1988a. "Gender and science education II," in P. Fensham, ed. *Development and Dilemmas in Science Education*. Falmer Press. pp. 218-248. Amazon.com information at < http://tinyurl.com/6n622p >. Note the "Search Inside" feature. See also "Gender and science education I" [Sjøberg and Imsen (1988)] in the same volume.

Kahle, J.B. 1988a. "Recruitment and Retention of Women in College Science Majors." *Journal of College Science Teaching*. March/April: 382-384.

Kahle, J.B. 1998b. "Measuring progress toward equity in science and mathematics education" (NISE Brief Vol. 2, No. 3). Madison: University of Wisconsin–Madison, National Institute for Science Education, online as a 692 kB pdf at < http://tinyurl.com/63sn5v >.

Kahle, J.B. 1998c. "Reaching equity in systemic reform: How do we assess progress and problems" (Research Monograph No. 9). Madison: University of Wisconsin–Madison, National Institute for Science Education, online as a 404 kB pdf at < http://tinyurl.com/66kt5u >.

#EB *Kandel. E.R. 2006. *In Search of Memory: The Emergence of a New Science of Mind*. W.W. Norton. Norton information at < http://www2.wwnorton.com/catalog/fall06/032937.htm >. See also Squire & Kandel (2000).

Kass-Simon, G. & P. Farnes, eds. 1990. *Women Of Science: Righting The Record*. Indiana University Press, publisher's information at < http://www.iupress.indiana.edu/catalog/product_info.php?products_id=21053 >.

#CE #CS *Kastrup, H. & J.V. Mallow. 2003. "Post-constructivism: A New Approach to Physics Pedagogy," *AAPT Announcer* **33**(2):152; Madison, WI meeting of 2-6 August.

*Kearsley, G. 2008. "Explorations in Learning & Instruction: The Theory Into Practice Database," online at < http://tip.psychology.org/ > :

> "Intended to make learning and instructional theory more accessible to educators. The database contains brief summaries of 50 major theories of learning and instruction. These theories can also be accessed by learning domains and concepts."

#FSP Keller, Evelyn Fox. 2008. Homepage at MIT < http://web.mit.edu/sts/faculty/info/Keller_Evelyn-css.html >.

#FSP Keller, E.F. & H.E. Longino, eds. 1996. *Feminism & Science*. Oxford University Press. Amazon.com information at < http://tinyurl.com/3nko7j >. Note the "Look Inside" feature.

#FSP Keller, E.F. 1996. *Reflections on Gender and Science*. Tenth Anniversary Paperback Edition.Yale University Press; publisher's information at < http://yalepress.yale.edu/yupbooks/book.asp?isbn=0300065957 >. A Google "preview" is online at < http://tinyurl.com/4yd76y >.

> For commentary on Keller's position see, e.g., *What Makes Nature Tick?* [Newton (1997, pages 27 and 209)]; and the index entries for "Keller" in *A House Built on Sand: Exposing Postmodern Myths About Science* Koertge (1998).

Keller, E.F. 2002. M*aking Sense of Life: Explaining Biological Development with Models, Metaphors, and Machines*. Harvard University Press, publisher's information at < http://www.hup.harvard.edu/catalog/KELMAK.html >.

#IE Kelly, A.E., R.A. Lesh, J.Y. Baek. 2008. "Handbook of Design Research Methods in Education: Innovations in Teaching." Routledge Education; publisher's information at < http://tinyurl.com/4eazqs >. Amazon.com information at < http://tinyurl.com/4xsfgt >.

"This *Handbook* presents the latest thinking and current examples of design research in education. Design-based research involves introducing innovations into real-world practices (as opposed to constrained laboratory contexts) and examining the impact of those designs on the learning process. Designed prototype applications (e.g., instructional methods, software or materials) and the research findings are then cycled back into the next iteration of the design innovation in order to build evidence of the particular theories being researched, and to positively impact practice and the diffusion of the innovation.

The *Handbook of Design Research Methods in Education* -- the defining book for the field -- fills a need in how to conduct design research by those doing so right now. The chapters represent a broad array of interpretations and examples of how today's design researchers conceptualize this emergent methodology across areas as diverse as educational leadership, diffusion of innovations, complexity theory, and curriculum research.

This volume is designed as a guide for doctoral students, early career researchers and cross-over researchers from fields outside of education interested in supporting innovation in educational settings through conducting design research."

#SDMA Kessel, C. 2006a. "The trouble with SMPY." *AWM Newsletter* **36**(5): 27-30. [SMPY = Study of Mathematically Precocious Youth < http://www.vanderbilt.edu/Peabody/SMPY/ >; see Benbow & Lubinski (2008)].

Kessel, C. 2006b. "Proof and Prejudice: Women in Mathematics and Physics & Simpsons," RUME post of 26 April, online at < http://tinyurl.com/6jjkfd >. Kessel wrote wrote (not to be construed as the official positon of the AWM):

"I wonder if some context got lost from Schiebinger's statement. . . .[our insert - Londa Schiebinger as quoted by Trie (2006): "According to Schiebinger, women earn 46 percent of undergraduate math degrees in this country but represent only 8 percent of math professors"]. . . ., maybe she meant something like 'professors at Research 1 universities'?

In mathematics departments, tenure-eligible college faculty members are 31% female, other full-time faculty members are 47% female, and tenured faculty members are 17% female (Lutzer, Maxwell, & Rodi, 2002). In the 'top 10' mathematics departments, there are approximately 300 tenured faculty members; 16 of them are female (Jackson, 2004).

Somewhat related. . . .['Girls Just Want to Have Sums' in (Greenwald & Nester, 2006)]. . . ."

#SDMA Kessel, C. 2006c. "Perceptions and research: Mathematics, gender, and the SAT," *Focus* **26**(9): 14-15; online at < http://www.maa.org/pubs/december06focus.pdf > (2.4 MB). Kessel wrote:

> Camilla Benbow is the vice-chair of the National Mathematics Advisory Panel and has been recently appointed to the National Science Board, which oversees the National Science Foundation. Since 1980, the work of Benbow and her colleagues has received attention in the media ("Do males have a math gene?," *Newsweek*, 1980; "Academy of P.C. Sciences," *New York Times*, 2006) and in popular books (*Brain Sex: The Real Difference Between Men and Women*, 1991; *Boys and Girls Learn Differently!*, 2001), and recently on various web sites. This research is often perceived to support the view that humans have two extremely different patterns of cognition and behavior, and that these are explained by male and female brain differences.
>
> At the same time, criticisms and findings that conflict with work of Benbow and her colleagues have received little notice, in the media and even in academic writing. In this article, I describe some of those criticisms and findings, and their relevance for current studies.
>
> In 1980, Camilla Benbow and Julian Stanley published an article in *Science* entitled "Sex Differences in Mathematical Ability: Fact or Artifact?" They reported large genderdifferences in "mathematical reasoning ability." Their evidence was scores on the mathematics SAT taken by seventh and eighth graders as part of a talent search for a program at Johns Hopkins University. . . . . .
>
> In 1983, Benbow and Stanley published another article in *Science* entitled "Sex Differences in Mathematical Reasoning Ability: More Facts" They reported that in talent searches in 1980, 1981, and 1982, about 13 boys to every 1 girl scored above 700. The numbers were very small (see table). In 1986, Camilla Benbow and Robert Benbow wrote that, based on talent search results, "it is quite clear that there are very large sex differences in mathematical reasoning ability" and that extensive studies conducted over a 14-year period had failed to show an "exclusively environmental explanation."
>
> Between 1988 and 2000, the 13-to-1 ratio was reported in journal articles by Benbow and her colleagues (*Behavioral and Brain Science*, 1988; *Current Directions in Psychological Science*, 1992; *Psychological Scientist*, 2000). In 2000, Lubinski, Benbow, and Morelock gave the 13 to 1 ratio in the *International Handbook of Giftedness and Talent* and said, "Comparable ratios have been replicated across the U.S. in a number of talent searches (Benbow & Stanley, 1996), as well as in other cultures [no reference given]." *However, in 1997, Stanley reported that the ratio had fallen to 4 to 1*. [Our i*talics*.] Earlier studies, published in 1994, of talent searches at Johns Hopkins and Duke University had also reported different, smaller ratios obtained from larger samples (see table). In 2005, Hopkins researchers reported this ratio as 3 to 1.
>
> *Beyond Bias and Barriers*, a new report from the National Academies, notes the change from 13-to-1 to 3-to-1 and says, "This difference can obviously not be explained by biological factors and suggests that social and cultural changes in the education of men and women have influenced test scores." This echoes Schafer and Gray's earlier criticism that environmental and cultural factors could not be set aside. *Whatever the reason for the change in ratios, it seems unscientific to reiterate the 13-to-1 ratio, without explanation, when other studies consistently report conflicting findings.* [Our i*talics*.]

#DM Kessel, C. 2007. "Winnie and Math, " RUME post of Aug 18 17:15:40 EDT 2007; online at < http://tinyurl.com/6rjgyb >. Cathy Kessel, President of the Association for Women in Mathematics < http://www.awm-math.org/ >, wrote (not to be construed as the official positon of the AWM):

"The description of *Math Doesn't Suck* on the Amazon Web site states (in part):
****
As the math education crisis in this country continues to make headlines, research continues to prove that it is in middle school when math scores begin to drop—especially for girls—in large part due to the relentless social conditioning that tells girls they 'can't do' math, and that math is 'uncool.'
****
Where is this research about scores dropping 'especially for girls' in middle school?"

Kessel then quotes data from National Assessment of Educational Progress and NCLB-induced data from California to dispute the advertisements for McKellar's (2007) book that "research continues to prove that it is in middle school when math scores begin to drop—especially for girls," and concludes: "I think girls should be encouraged in mathematics -- but I don't see that a gender gap in middle school test scores is the reason."

RUME is a discussion list devoted to Research in Undergraduate Mathematics with archives at < http://betterfilecabinet.com/pipermail/rume_betterfilecabinet.com/ >. For a guide to discussion lists see "Over Sixty Academic Discussion Lists: List Addresses and URL's for Archives & Search Engines" [Hake (2007d)].

Kilpatrick, J., J. Swafford, & B. Findell, eds. 2001. *Adding It Up: Helping Children Learn Mathematics*, Mathematics Learning Study Committee, National Research Council, National Academy Press, online at < http://books.nap.edu/catalog/9822.html >. Kilpatrick *et al.* wrote:

a. On page 315: Much debate centers on the form and approaches to teaching: "direct instruction" versus "inquiry," "teacher centered" versus "student centered," traditional versus "reform." These labels make rhetorical distinctions that often miss the point regarding the quality of instruction. Our review of the research makes plain that the effectiveness of mathematics teaching and learning does not rest on simple labels. Rather, the quality of instruction is a function of teachers' knowledge and use of mathematical content, teachers' attention to and handling of students, and students' engagement in and use of mathematical tasks.

b. On page 351: "The role of practice in mathematics in mathematics, as in sports and music, is to be able to execute procedures automatically without conscious thought. That is, a procedure is practiced over and over again until so-called *automaticity* is attained [Hiebert (1990)]" [*Italics* in the original.]

#FSC #FSP Kilty, K. T., K. Allen, D. Pushkin, C. Barker, E. Finkel. 1998. "Reader Responses to 'Physics and Feminism,' May 1998 by Priscilla Auchincloss," *APS News*, July, online at < http://www.aps.org/publications/apsnews/199807/back-page.cfm >. [See Auchincloss 1998.] Respondent Crystal Barker wrote:

> "Physics, more feminist? Physics does not need to be more anything - except appreciated. It certainly does not need to be more feminist. Yes, I have encountered bias from males in physics, as well as the occasional derogatory remark or tasteless comment. But one should be careful not to confuse the science with the scientist. Auchincloss tells us that the group provides 'criticism or approval, and the paradigm to allow integration of the various parts of the puzzle.' So now objectivity is a paradigm, and not a primary assumption? Is she trying to explicate the scientific method and concomitant practice of peer-review? If so, she's done a poor job. Couching it in the language of feminist rhetoric lessens the impact of the power of reproducibility. Reproducibility means that when I make an observation, you can make the same observation independently, whether you like me or not, agree with my lifestyle, philosophy, or gender. This is where science derives its power and beauty. There is nothing exclusionary or oppressive here. *I think Auchincloss' energies would be better spent improving the overall quality of physics education*. This way, when an argument is lost due to lack of knowledge, no one need cry 'sex discrimination' or worse, 'old boy network.' " (Our *italics*.)

#EB #SDMA Kimura, D. 2000. *Sex and Cognition.* MIT Press, publisher's information at < http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=4364 >. Amazon.com information at < http://tinyurl.com/6pd2nb >. Note the "Look Inside" feature. The following quote is at the MIT press site:

> "Kimura provides an authoritative overview of the field of sex differences in cognition, moving from hormones to cognition, genes to behavior, in a calm and clear way. This book will be a valuable resource for students and teachers of cognitive science."-- Simon Baron-Cohen, Departments of Experimental Psychology and Psychiatry, University of Cambridge, UK.
>
> Doreen Kimura < http://www.sfu.ca/~dkimura/dkhome.htm > writes: "I have a post-retirement visiting professorship at Simon Fraser University in Burnaby, British Columbia. Prior to that I spent over 30 years at the University of Western Ontario in London, Canada."

#EB #SDMA Kimura, D. 2002. "Sex Differences in the Brain," *Scientific American*, 13 May 13, abstract online at < http://tinyurl.com/548ube >. Kimura wrote:

> "Men and women differ not only in their physical attributes and reproductive function but also in many other characteristics, including the way they solve intellectual problems. For the past few decades, it has been ideologically fashionable to insist that these behavioral differences are minimal and are the consequence of variations in experience during development before and after adolescence. *Evidence accumulated more recently, however, suggests that the effects of sex hormones on brain organization occur so early in life that from the start the environment is acting on differently wired brains in boys and girls*. [Our *italics*.] Such effects make evaluating the role of experience, independent of physiological predisposition, a difficult if not dubious task. The biological bases of sex differences in brain and behavior have become much better known through increasing numbers of behavioral, neurological and endocrinological studies."

#SSIGD #SDMA Kimura, D. 2004. "Hysteria trumps academic freedom," *Vancouver Sun*, p. A13, 1 February; online at < http://www.sfu.ca/~dkimura/articles/hysteria.htm >. Kimura wrote:

> The recent suggestion by Larry Summers, Harvard University president, that one of the factors contributing to the lower representation of women in the sciences might be innate differences between the sexes has unleashed the predictable fury from feminists and their fellow ideologues. The responses to Summers indicate once again how little respect many in academia really have for the principles of academic freedom and rational discussion. Even had he been mistaken, the reaction should have been more moderate, but as it happens he was not.
>
> Men and women do differ in their intellectual talents, and if by "innate" we mean influenced or determined before birth, then some of these differences are indeed innate. Differentiation between the sexes depends heavily on the difference between them in levels of sex hormones early in prenatal life. These hormone levels determine not only the physical differences, but also strongly influence many behaviours into adulthood. Those behaviours include the intellectual or cognitive pattern, hormonal influences being especially well documented for certain kinds of spatial ability, like being able to mentally rotate or manipulate visual objects.
>
> Men are, on average, better on such spatial tasks and on mathematical reasoning tasks than are women. Women, in contrast are better, on average, on tasks requiring verbal memory (recalling word material), and also in recalling the position of objects presented in an array. There are many other less striking differences.
>
> Mathematical reasoning ability is especially important for physical sciences like physics and engineering, and since many more men than women score at the high end of math aptitude tests, it is reasonable to expect that more men will go into those professions. Note that boys and girls may not differ in their grades on math tests in school, but the same boys still excel on math aptitude tests, where the items are less rehearsed. . . . . .
>
> Lest some people think that women still suffer discrimination in hiring in academia, the research, in Canada at least, shows just the opposite. Several studies have shown that women are favoured over men in university faculty hiring, including my own survey of hiring at two major British Columbia universities. Women's groups have been sadly effective at crying victim, to the point where men have become disadvantaged.
>
> Dr. Summers has now disappointed all serious academics by his subsequent apology and retraction, bowing to pressures originating, not from thoughtful critiques of his remarks, but from hysterical reactions of special interest groups. His response is mirrored in too many university and research grant administrations, where the tired refrain is that women still suffer "serious obstacles", at best only vaguely defined, to success in science.

#SDMA Kimura, D. 2007. "Under-representation" or Misrepresentation?" in Ceci & Williams (2007); online at < http://www.sfu.ca/~dkimura/articles/Ceci%20Essay.htm >. Kimura wrote:

> "The Scholastic Aptitude Test- Mathematics (SAT-Math) has consistently over several decades yielded an advantage in High School age males. The participants selected for Benbow's (1988) studies of mathematically precocious youth (SMPY) have consistently shown a greater number of males. Even within this select group of boys and girls the average scores of boys are higher. The ratio of boys to girls at the high end of the distribution of scores is about ten to one. . . . .[our insert - according to Monastersky (2005), the ratio in 2005 was 2.8 to 1]. . . . In the Putnam competition, open to all undergraduates in North America, what data we have suggests a huge preponderance of males who get the higher scores, even correcting for the larger numbers of male applicants. To date, all the recipients of the Fields medal, a prestigious award in mathematics, have been men."

[CE] *Kirschner, P.A., J. Sweller, & R.E. Clark. 2006. "Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching." *Educational Psychologist* **41**(2): 75-86; online at < http://tinyurl.com/3xmp2m > (176 kB).

For a critique see "Language Ambiguities in the Learning Sciences" [Hake (2008a)].

[#SSB] Kleinfeld, J. 1998. "The Myth That Schools Shortchange Girls: Social Science in the Service of Deception," online at < http://www.uaf.edu/northern/schools/myth.html >; prepared for "The Women's Freedom Network" < http://www.womensfreedom.org/ >. According to < http://www.judithkleinfeld.com/ >, Kleinfeld is the Director of Northern Studies Program and a Professor of Psychology at the University of Alaska Fairbanks.

[#MIT] Kleinfeld, J. 1999. "MIT Tarnishes Its Reputation with Gender Junk Science," online at < http://www.uaf.edu/northern/mitstudy/mittarn.pdf > (188 kB). This appears on the "Independent Women's Forum (IWF) website – see IWF (2008).

*Klymkowsky, M.W., K. Garvin-Doxas, & M. Zeilik. 2003. "Bioliteracy and Teaching Efficiency: What Biologists Can Learn from Physicists," *Cell Biology Education* **2**: 155-161; online at < http://www.lifescied.org/cgi/reprint/2/3/155 >. The abstract reads:

"The introduction of the Force Concept Inventory (FCI) by David Hestenes and colleagues in 1992. . . .[our insert – Hestenes *et al*. (1992)]. . . produced a remarkable impact within the community of physics teachers. An instrument to measure student comprehension of the Newtonian concept of force, the FCI demonstrates that active learning leads to far superior student conceptual learning than didactic lectures. Compared to a working knowledge of physics, biological literacy and illiteracy have an even more direct, dramatic, and personal impact. They shape public research and reproductive health policies, the acceptance or rejection of technological advances, such as vaccinations, genetically modified foods and gene therapies, and, on the personal front, the reasoned evaluation of product claims and lifestyle choices. While many students take biology courses at both the secondary and the college levels, there is little in the way of reliable and valid assessment of the effectiveness of biological education. This lack has important consequences in terms of general bioliteracy and, in turn, for our society. Here we describe the beginning of a community effort to define what a bioliterate person needs to know and to develop, validate, and disseminate a tiered series of instruments collectively known as the Biology Concept Inventory (BCI), which accurately measures student comprehension of concepts in introductory, genetic, molecular, cell, and developmental biology. The BCI should serve as a lever for moving our current educational system in a direction that delivers a deeper conceptual understanding of the fundamental ideas upon which biology and biomedical sciences are based."

Klymkowsky, M.W. 2007. "Bioliteracy.net," online at < http://bioliteracy.net/ > :

"Our goal is to generate, test and distribute the tools to determine whether students are learning what teachers think they are teaching. We assume that accurate and timely assessment of student knowledge will pressure the educational world toward more effective teaching. WHY? (a) Because basic understanding of the biological sciences impacts our lives in more and more dramatic ways every year; (b) A wide range of important personal, social, economic and political decisions depend upon an accurate understanding of basic biology and the means by which science generates, tests and extends our knowledge."

[FSC #CS] Koertge, N. ed. 1998. *A House Built on Sand: Exposing Postmodern Myths About Science*. Oxford University Press, publisher's information at < http://tinyurl.com/3824km >.

For anti-postmodernist comment on the work of Ruth Bleier, Donna Haraway, Sandra Harding, Evelyn Fox Keller, Helen Longino, and Londa Schiebinger see the corresponding index headings. For a more recent book in this vein see *Scrutinizing Feminist Epistemology: An Examination of Gender in Science* [Almeder *et al*. (2003)].

The back cover of Koertge (1998) carries a testimonial from Dudley Herschbach (1986 Chemistry Nobelist): "Critics as well as admirers of science will find in these essays much that deserves to be taken to heart, head, and hearth. Large wings of the rambling postmodern house suffer from shoddy work and rambling footing. This should help both cultural scholars and scientists to find bedrock for sturdy construction rather than cynical deconstruction."

Kulis, S., D. Sicotte, S. Collins. 2002. "More than a Pipeline Problem: Labor Supply Constraints and Gender Stratification Across Academic Science Disciplines," *Research in Higher Education* **43**(6); online at < http://www.public.asu.edu/%7Eatssk/ssk_rhe02b.pdf > (264 kB).

[#CS] *Larbinger, J.A. & H. Collins, eds. 2001. *The One Culture? A Conversation about Science*, University of Chicago Press. Amazon.com information at < http://tinyurl.com/3t4kox > Note the "Search Inside" feature. Publisher's information at < http://www.press.uchicago.edu/cgi-bin/hfs.cgi/00/14218.ctl > :

"So far the 'Science Wars' have generated far more heat than light. Combatants from one or the other of what C. P. Snow famously called 'the two cultures' (science versus the arts and humanities) have launched bitter attacks but have seldom engaged in constructive dialogue about the central issues. In *The One Culture?,* Jay A. Labinger and Harry Collins have gathered together some of the world's foremost scientists and sociologists of science to exchange opinions and ideas rather than insults. The contributors find surprising areas of broad agreement in a genuine conversation about science, its legitimacy and authority as a means of understanding the world, and whether science studies undermines the practice and findings of science and scientists. . . . . Contributors include: Constance K. Barsky, Jean Bricmont, Harry Collins, Peter Dear, Jane Gregory, Jay A. Labinger, Michael Lynch, N. David Mermin, Steve Miller, Trevor Pinch, Peter R. Saulson, Steven Shapin, Alan Sokal, Steven Weinberg, & Kenneth G. Wilson."

Laws, P., P. Rosborough, & F. Poodry. 1999. "Women's responses to an activity-based physics program," *Phys. Educ. Res. Suppl., Am. J. Phys.* **67**(7): S32-S37; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=67&Issue=S1 >. Laws *et al.* conclude:

"What have we learned from our Workshop Physics experience about the potential for activity-based constructivist science courses to attract more women to the study of science? We don't seem to detect a significant gender gap in attitudes toward the study of science between men and women who take physics as underclassmen. If the negative attitude of upper-class women is related primarily to socialization in other science and mathematics courses, we can close the gender gap for all women. To do this we should expose women to many courses that encourage reasoning and direct observations early in their schooling and in their college careers. *We must take steps to promote educational reform at all levels and in all subject areas, especially science and mathematics, so that students understand how vital and empowering the process of constructing scientific knowledge can be*." (Our *italics*.)

*Lawson, A.E. 1995. *Science Teaching and the Development of Thinking*, Wadsworth. Appendix F contains the "Classroom Test of Scientific Reasoning"; according to Lawson, a test of "ability to apply aspects of scientific and mathematical reasoning to analyze a situation, make a prediction, or solve a problem." Amazon.com information at < http://tinyurl.com/2os2y4 >. Note the "Look Inside" feature. A multiple choice version of the test (August 2000) is online at < http://tinyurl.com/jtbsd >.

#EB *Lawson, A.E. 2003. *The Neurological Basis of Learning, Development and Discovery: Implications for Science and Mathematics Instruction*. Springer. Amazon.com information at < http://tinyurl.com/2ue87x > :

"*The Neurological Basis of Learning, Development and Discovery* is unique in that it: (a) links neural physiology and neural network theory with cognition and instructional practice; (b) grounds the current emphasis on inquiry and constructivism in epistemological, philosophical and developmental theory; (c) *links neural network theory, learning theory, conceptual change theory, and scientific discovery to classroom practice* (our *italics*); (d) provides examples of scientifically-based research in education as a guide for science and math educators and graduate students; (e) has examples of lessons that can teach discipline-specific concepts as well as provoke the development of general reasoning/argumentative skills; (f) can be used in graduate-level courses in science education and in-service courses for science teachers."

#EB *Lawson, A.E. 2006. "Points of View: On the Implications of Neuroscience Research for Science Teaching and Learning: Are There Any?" *CBE-Life Sciences Education* **5**: 111-117, online at < http://www.lifescied.org/cgi/content/full/5/2/111 >.

Leamnson, R. 1999. "*Thinking About Teaching and Learning: Developing Habits of Learning with First Year College and University Students*." Stylus. Stylus information at < http://styluspub.com/Books/BookDetail.aspx?productID=20839 >.

#EB Leamnson, R. 2000. "Learning as Biological Brain Change," *Change*, November/December; online at < http://www.umassd.edu/cas/biology/lbk1.cfm >.

Lederman, L.M. 1999. "A science way of thinking." *Education Week*, 16 June; [Lederman is a 1988 Physics Nobelist]; online at
< http://www.edweek.org/ew/articles/1999/06/16/40leder.h18.html > (our *italics*):

> *Our reform thrust, in military metaphor, is toward a weak section of the barriers to change that surround the school system*s. We have observed that 99 percent of our high schools teach biology in 9th (or 10th) grade, chemistry in 10th or 11th grade, and, for survivors, physics in 11th or 12th grade. This is alphabetically correct, but by any logical scientific or pedagogical criteria, the wrong order. A standards-based science curriculum must contain at least three years of science and three years of mathematics. And the coherent order begins with 9th grade physics, *taught conceptually* and exercising only the math of 8th and 9th grade; then chemistry, building on the knowledge of atomic structure to study molecules; then the crowning glory of modern, molecular-based biology_ . . . . We stress that this is a design for *all* students . . . (***even including young women*!).** . . , work bound, liberal arts-college-bound, or science-and-technology-bound. The schools that are "doing it right" report greatly expanded enrollments in fourth-year electives and Advanced Placement science courses. *Thus, a solid, core curriculum will enlarge rather than* . . . (diminish the pool of). . . *future scientists*.
>
> See also "Physics First: Precursor to Science/Math Literacy for All?" [Hake (2002d)] and "Physics First: Opening Battle in the War on Science/Math Illiteracy?" [Hake (2002e)].

Lederman, L.M. 2000. "A Plan, A Strategy for K-12," in *Who Will Do the Science of the Future? A Symposium on Careers of Women in Science* [NAP (2000a)], pp. 7- 11: Lederman wrote:

> "We hear that after the new sequence is installed, increases take place in fourth-year science electives, enrollment in AP science courses zooms up, college successes are recorded, and then, here is the funny thing, *there is a dramatic effect on women and minority students from poor families who come into high school without a strong positive science and math experie*nce. (Our *italics*.) Many of these. . .(new sequence). . .schools tell us things like 'AP physics how has 53% women.' I remember AP physics as having one, two, or no women. What is going on?"

Lederman, M. & I. Bartsch, eds. 2000. *Gender and Science Reader*. Routledge. Amazon.com information at < http://tinyurl.com/2htdyh >. Note the "Search Inside" feature.

Lee, O. 1998. "Current Conceptions of Science Achievement in Major Reform Documents and Implications for Equity and Assessment," NISE Research Monograph No. 12, online at
< http://www.wcer.wisc.edu/archive/nise/Publications/Research_Monographs/LEE/LeeALL.pdf > (172 KB).

*Lemee, S. 2008. "Plenty to Go Around," *Inside Higher Ed*, 25 June, online at
< http://insidehighered.com/views/2008/06/25/mclemee >. Lemee wrote:

> "A new book . . . . .[our insert [Proctor & Schieinger (2008)]. . . . from Stanford University Press called *Agnotology: The Making and Unmaking of Ignorance* proposes that such a field of study is necessary – that we need rigorous and careful thinking about the structure and function and typology of cluelessness. The editors, Robert N. Proctor and Londa Schiebinger, are both professors of history of science at Stanford University. Their volume is a collection of papers by various scholars, rather than a systematic treatment of its (perhaps inexhaustible) subject. But the field of agnotology seems to cohere around a simple, if challenging, point: Ignorance, like knowledge, is both socially produced and socially productive."

Leonard, D.K. & J. Jiang. 1999. "Gender Bias and College Predictions of the SATS: A cry of Despair," *Research in Higher Education* **40**(4): 375-404; abstract online at < http://www.springerlink.com/content/h6281168x5870j21/ >:

Abstract: "This study reviews and extends the considerable literature demonstrating that the various College Board examinations (most importantly the Scholastic Aptitude Tests) make a small underprediction of women"s college grades relative to those of men in all fields except engineering. This finding persists even when corrections are made for differences in the fields that women and men study and for sample selection bias. Because of this underprediction, women most probably are underrepresented relative to their merit in freshman classes and scholarship competitions at selective public universities. The differences in predicted grades are small, but account for an underrepresentation of women by at least 5% of the freshman classes of the University of California at Berkeley (200 to 300 a year) in the late 1980s. Various solutions to this underprediction by the SATs and the dilemmas they pose for public universities such as Berkeley are explored."

See also "Fighting the Gender Gap: Standardized Tests Are Poor Indicators of Ability in Physics" [APS News (1996)] and "Achievement Versus Aptitude in College Admissions" [Atkinson (2001)].

#SDMA Levin, M. 1990. "Women – why so few," *Am. J. Phys.* **58**(10): 905-906; online at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=58&Issue=10 >. A response to "Why so few women?" [Button-Shafer (1990)]. For a response to Levin see "Guest Comment: Are there innate cognitive gender differences? Some comments on the evidence in response to a letter from M. Levin" [Ruskai (1991)].

Levin cites the research of Benbow & Stanley (1981, 1983) purporting to show that are intrinsic gender differences in favor of males at the highest level of mathematical performance. This and other work of Benbow has been criticized in "Concern regarding the inclusion of Dr. Camilla Benbow on the National Mathematics Advisory Panel" [AWM (2005)] and Kessel (2006c). According to < http://en.wikipedia.org/wiki/Michael_Levin > :

Professor Levin is known for his controversial views in philosophy. He is critical of certain strands of feminism. . . . . Levin also believes that genetics play an important part in the variation in cultures across the world. He advocates reliabilism as the correct theory of epistemology, and compatibilism as the correct theory of free will. Professor Levin has written for libertarian publications such as the Ludwig von Mises Institute's newsletter *The Free Market* and *The Journal of Libertarian Studies*. He has garnered attention for defending torture for political purposes as far back as 1982, in an opinion article featured in *Newsweek* magazine.

*Lewin, T. 2008. "Report Urges Changes in Teaching Math," *New York Times*, 14 March, online at < http://tinyurl.com/2hv8zb >.

*Library of Congress. 2006a. "Blacks in the Sciences and Related Disciplines," Tracer Bullet 89-9, Science Reference Services; online at < http://www.loc.gov/rr/scitech/tracer-bullets/blacksinscitb.html >.

Library of Congress. 2006b. "Women in the Sciences," Tracer Bullet 90-6, Science Reference Services; online at
< http://www.loc.gov/rr/scitech/tracer-bullets/womensciencetb.html > :

"This is a guide to sources relating to the history and contributions of women in the fields of science, medicine, and engineering. Also included are writings on present-day women scientists, as well as materials on the current status and concerns of women in the sciences. Of possible interest to users of this work are *Blacks in Science and Related Disciplines (TB 89-9)* and *Biographical Sources in the Sciences (TB 88-3)*. An update of Tracer Bullet 83-8, this compilation is not intended to be a comprehensive bibliography but is designed—as the name of the series implies—to put the reader "on target."

#EB *Library of Congress, 2006c. "The Brain," Tracer Bullet 90-10, Science Reference Services; online at < http://www.loc.gov/rr/scitech/tracer-bullets/braintb.html.html >.

#IPCS *Lindenfeld, P. 2001. "We can do better: A Report on Some Teaching Innovations," Forum on Physics and Society Newsletter, July; online at
< http://www.aps.org/units/fps/newsletters/2001/july/701art1.pdf > (16 kB): Lindenfeld wrote (our *italics*):

"At Rutgers University we are trying to address several of the major problem areas: the declining number of physics majors, the dissatisfaction with the introductory courses, the barrier that physics courses represent for students who are not well prepared, the often marginal support system that we provide for our students, and the neglect of these problems by many members of the faculty. We have the normal physics major curriculum with standard courses and provision for honors projects. It provides excellent preparation for graduate school. *If this 'professional' major were our only one, we would have of the order of ten graduates per year, as is true for comparable institutions*. [Our *italics*.] Some decades ago we added the 'general' major, with a less demanding curriculum, based on the premise that we can provide substantive science-based education to students who do not intend to pursue a research career in physics. . . .[our insert – 'Curriculum S'?]. . . This . . . (the 'general major,' two new full year post-introductory courses, a 5-year program in conjunction with the College of Engineering, and an applied physics major). . . *puts us in the rarified range of 45 graduating seniors this year* . . . . Our efforts have to continue, for the sake of the students, and for our own. We can do better!"

See also "Lessons learned: A case study of an integrated way of teaching introductory physics to at-risk students at Rutgers University" [Etkina *et al*. (1999)].

#IPCS *Lindenfeld, P. 2002. "Guest Comment: Format and content in introductory physics," *Am. J. Phys*. **70**(1): 12-13; online to subscribers at
< http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=70&Issue=1 >.

#SV Linn, M.C. & A.C. Petersen. 1985. "Emergence and characterization of gender differences in spatial ability: A meta-analysis," *Child Development* **56**: 1479-1498.

#SV Linn, M.C. & A.C. Petersen. 1986. "A meta-analysis of gender differences in spatial ability: Implications for mathematics and science achievement," in Hyde & Linn (1986).

[SDMA] Linn, M.C. & C. Kessel. 2003. "Gender differences in cognition and educational performance," in Lynn Nadel, ed. *Encyclopedia of cognitive science* (pp. 261–267). Nature Publishing Group. Amazon.com information at < http://tinyurl.com/4mnqpo >.

[#SDMA] Linn, M.C. & C. Kessel. 2006. Review of *Gender Differences in Mathematics* [Gallagher & Kaufman (2005)]. *AWM Newsletter* **36**(5): 20-27.

[#SDMA] ‡ Linn, M. & C. Kessel. 2007. "Gender Differences in Mathematics," *Psychology of Women Quarterly* **31**: 323–324; online to subscribers at < http://www.blackwellpublishing.com/journal.asp?ref=0361-6843&site=1 > . This is a shortened and altered version of Linn & Kessel (2006).

[#SDMA] Linn, M. 2007. "Women In Science: Can Evidence Inform the Debate?" *Science* 317(5835): 199 - 200, 13 July, review of Ceci & Williams (2006); online at < http://tinyurl.com/4fltw3 >. Linn wrote:

> "The chapter by David Lubinski and Camilla Benbow is one of several that mentions the 1980s talent search by Benbow and Julian Stanley, in which they recruited students under 14 to take the SAT and found that for scores over 700 (two standard deviations above the mean), the ratio was 13 boys to 1 girl. By 1997, the ratio had dropped to about 4 to 1 [*Stanley (1997)*]; it has recently fallen further to 2.8 to 1 [*Monastersky (2005)*]. [Our *italicised* references.] These large differences motivate some contributors to criticize others for ignoring the evidence for males' superior abilities in science. In the most dramatic statement, Doreen Kimura argues that giving special scholarships or grants exclusively to women "bribes them to enter fields they may neither excel in nor enjoy."

Lips, H.M. 2004. *Sex and Gender: An Introduction.* McGraw-Hill. Amazon.com information at < http://tinyurl.com/642rz7 >.

[#CE] *Lochhead, J. 1988. "Some Pieces of the Puzzle," in Forman & Pufall (1988), pp. 71-81, online at < http://www.questia.com/PM.qst?a=o&d=13634588 >.

[#FSP] Longino, Helen. 2004. Homepage at the University of Minnesota, < http://www.philosophy.umn.edu/people/faculty/longino.html >.

Lopez, R.E. 2001. "Promoting Diversity in Physics," *APS Forum on Education Newsletter*, Summer; online at < http://www.aps.org/units/fed/newsletters/summer2001/lopez.html >.

*Lopez, R.E. & T. Schultz. 2001. "Two Revolutions in K-8 Science Education." *Physics Today* 54(9): 44-49; online at < http://scitation.aip.org/journals/doc/PHTOAD-ft/vol_54/iss_9/44_1.shtml >.

[#SV] Lord, T.R. 1987. "A Look at Spatial Abilities in Undergraduate Women Science Majors," *Journal of Research in Science Teaching* 24(8): 757-767; abstract online at < http://tinyurl.com/6qs5n8 >.

#IE Lorenzo, M., C.H. Crouch, & E. Mazur. 2006. "Reducing the Gender Gap in the Physics Classroom," *American Journal of Physics* **74**(2): 118-122; online at < http://mazur-www.harvard.edu/publications.php?function=search&topic=9 >.

See also "Reducing the Gender Gap in the Physics Classroom: How sufficient is interactive engagement?" [Pollock *et al*. (2007]).

#EC *Lowell, B.L. & H. Salzman. 2007. "Into the Eye of the Storm: Assessing the Assessing the Evidence on Science and Engineering Education, Quality, and Workforce Demand," Urban Institute; online at < http://www.urban.org/url.cfm?ID=411562 >. The full paper is at < http://www.urban.org/UploadedPDF/411562_Salzman_Science.pdf > (184 kB). The first two paragraphs of the abstract are:

"Several high-level committees have concluded that current domestic and global trends are threatening America's global science and engineering (S&E) preeminence. Of the challenges discussed, few are thought to be as serious as the purported decline in the supply of high quality students from the beginning to the end of the S&E pipeline—a decline brought about by declining emphasis on math and science education, coupled with a supposed declining interest among domestic students in S&E careers.

However, our review of the data fails to find support for those presumptions. Rather, the available data indicate *increases* in the absolute numbers of secondary school graduates and *increases* in their math and science performance levels. Domestic and international trends suggest that that U.S. schools show steady improvement in math and science, the U.S. is not at any particular disadvantage compared with most nations, and the supply of S&E-qualified graduates is large and ranks among the best internationally. Further, the number of undergraduates completing S&E studies has grown, and the number of S&E graduates remains high by historical standards. Why, then, is there a purported failure to meet the demand for S&E college students and S&E workers?"

Somewhat similar arguments were made in *The Manufactured Crisis* [Berliner & Biddle (1996)]. We do not think the arguments of Berliner & Biddle (1996) and Lowell and Salzman (2007) diminish the crucial need to increase the science/math literacy [and, for that matter, the historical and literary literacy – see Doctorow (2008)] of the general population so as to increase the probability of survival of life on planet Earth - see Part 2, Section C2: "Preservation of Life on Planet Earth."

#SDMA Lubinski, D.S. & C. Benbow. 1992. "Gender Differences in Abilities and Preferences Among the Gifted: Implications for the Math-Science Pipeline," *Current Directions in Psychological Science* **1**: 61-66; online at < http://www.vanderbilt.edu/Peabody/SMPY/CurrentDirections.pdf > (2.3 MB)

#SDMA Lubinski, D.S. & C. Benbow. 2006a. "Sex Differences in Personal Attributes for the Development of Scientific Expertise," in Ceci & Williams (2006).

#SDMA Lubinski, D.S. & C. Benbow. 2006b. "Study of Mathematically Precocious Youth After 35 Years: Uncovering Antecedents for the Development of Math-Science Expertise," *Perspectives On Psychological Science* **1**(4): 316-345; online at < http://www.vanderbilt.edu/Peabody/SMPY/DoingPsychScience2006.pdf > (616 kB).

Abstract: "This review provides an account of the Study of Mathematically Precocious Youth (SMPY) after 35 years of longitudinal research. Findings from recent 20-year follow-ups from three cohorts, plus 5- or 10-year findings from all five SMPY cohorts (totaling more than 5,000 participants), are presented. SMPY has devoted particular attention to uncovering personal antecedents necessary for the development of exceptional math-science careers and to developing educational interventions to facilitate learning among intellectually precocious youth. Along with mathematical gifts, high levels of spatial ability, investigative interests, and theoretical values form a particularly promising aptitude complex indicative of potential for developing scientific expertise and of sustained commitment to scientific pursuits. . . . . in the SMPY cohorts, although more mathematically precocious males than females entered math-science careers, this does not necessarily imply a loss of talent because the women secured similar proportions of advanced degrees and high-level careers in areas more correspondent with the multidimensionality of their ability-preference pattern (e.g., administration, law, medicine, and the social sciences). By their mid-30s, the men and women appeared to be happy with their life choices and viewed themselves as equally successful (and objective measures support these subjective impressions). Given the ever-increasing importance of quantitative and scientific reasoning skills in modern cultures, *when mathematically gifted individuals choose to pursue careers outside engineering and the physical sciences, it should be seen as a contribution to society, not a loss of talent*." [Our *italics*.]

Lutzer, D. J., J.W. Maxwell, & S.B. Rodi 2002. "Statistical abstract of undergraduate programs in the mathematical sciences in the United States. Fall 2000, CBMS Survey," American Mathematical Society, online at < http://www.ams.org/cbms/cbms2000.html >.

*MAA. 2008. Mathematics Association of America, "Teaching Mathematics." Online at < http://www.maa.org/reviews/tindex18.html >.

*MacIsaac, D., R. Cole, D. Cole, L. McCullough, & J. Maxka. 2002). "Standardized Testing in Physics via the World Wide Web," *Electronic Journal of Science Education* **6***(3)* March; online at < http://wolfweb.unr.edu/homepage/crowther/ejse/macisaacetal.pdf > (96kB).

Macklis, R.M. 2002. "Scientist, Technologist, Proto-Feminist, Superstar," *Science* **295**: 1647-1648, 1 March; online at < http://www.sciencemag.org/cgi/content/full/295/5560/1647 >. Macklis wrote (our italics):

"With the possible exception of Albert Einstein, Marie Curie was the most famous scientist of her era and is almost certainly the most celebrated female scientist in history.. . . She was one of the exceedingly rare Nobel laureates to win the prize twice (physics and chemistry). Her life will forever reflect dogged determination, unswerving devotion to work, political tenacity, and an optimistic belief in scientific positivism. *On a more personal note, she unfortunately has also come to symbolize a cautionary tale concerning the difficulties encountered when a woman enters and succeeds dramatically and publicly in a sphere traditionally dominated by men*." (Our *italics*.)

Maddox, B. 2002. *Rosalind Franklin: The Dark Lady of DNA*. Harper Collins. Amazon.com information at < http://www.amazon.com/Rosalind-Franklin-Dark-Lady-DNA/dp/0060184078 >. Note the "Search Inside" feature. A Google "book preview" is online at < http://tinyurl.com/3jlz5u >. Reviewed by Reilly (2006).

#IE *Mahajan, S. & R.R. Hake. 2000. "Is it time for a physics counterpart of the Benezet/Berman math experiment of the 1930's?" *Physics Education Research Conference 2000: Teacher Education* < http://www.sci.ccny.cuny.edu/~rstein/perc2000.htm >; online at < http://arxiv.org/pdf/physics/0512202 >, and as ref. 6 at < http://www.inference.phy.cam.ac.uk/sanjoy/benezet/ >.

We suggest a K-12 science curriculum inspired by and compatible with the virtually forgotten pioneering work of Benezet (1935/36) [See the Benezet Centre < http://www.inference.phy.cam.ac.uk/sanjoy/benezet/ >].

Maher F.H., & M. K. T. Tetreault. 1994. *The Feminist Classroom*. Basic Books; publisher's information at < http://www.perseusbooksgroup.com/basic/book_detail.jsp?isbn=0465023541 >.

#LPE *Makhijani, A. 2007. *Carbon-Free and Nuclear-Free: A Roadmap for US Energy Policy*. Ieer Press. Online as a 4.4 MB pdf at < http://www.ieer.org/carbonfree/index.html >. We thank Hugh Haskell for calling our attention to this book. EggheadBooks information at < http://www.eggheadbooks.org/books/carbonfree.htm >:

"In a world confronting global climate change, political turmoil among oil exporting nations, nuclear weapons proliferation, nuclear plant safety and waste disposal issues, the United States must assume a leadership role in moving to a zero-CO_2-emissions energy economy. At the same time, the U.S. needs to take the lead in reducing the world's reliance on nuclear power. This breakthrough joint study by the Institute for Energy and Environmental Research and the Nuclear Policy Research Institute shows how our energy needs can be met by alternative sources. Wind, solar, biomass, microalgae, geothermal and wave power are all part of the solution. *Carbon-Free and Nuclear-Free* is must reading for people concerned with energy politics and everyone who wants to take action to protect the planet's future."

Amazon.com information at < http://tinyurl.com/3l6jd6 >.

A good review by John Roeder, soon to be on the *Teachers Clearinghouse for Science and Society Education Newsletter* < http://www.physics.rutgers.edu/~lindenf/pse/ > can be download at < http://tinyurl.com/4ba8el > - scroll to the bottom and click on <Reviews(W08).doc>.

#AA Malcom, S.M., D.E. Chubin, J.K. Jesse. 2004. *Standing Our Ground: A Guidebook for STEM Educators in the Post-Michigan Era* AAAS and NACME (National Action Council for Minorities in Engineering); online as a 4.6 MB pdf at < http://tinyurl.com/yv39jg >.

Mallow, J.V. 1986. *Science Anxiety: Fear of Science and How to Overcome It*. H & H Publications. Amazon.com information at < http://tinyurl.com/3vsatr >.

Mallow, J.V. 1987. "Science anxiety and gender," *Bull. Science Technol. and Society* **7**: 958-962, online to subscribers at < http://bst.sagepub.com/cgi/reprint/7/3-4/958 >.

Mallow, J.V. 1993. "The Science Learning Climate: Danish Female and Male Students' Descriptions," *GASAT* 7 (1): 75-87. See GASAT#7 (1993)].

Mallow, J.V. 1994. "Gender-related Science Anxiety: A First Binational Study." *Journal of Science Education and Technology* **3**(4): 227-238; online to subscribers at < http://www.springerlink.com/content/gqt46p10j78v510v/ >.

Mallow, J.V. 1995. "Students' Confidence and Teachers' Styles: A Binational Comparison," *Am. J. Phys*. **63**(11): 1007-1011; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=63&Issue=11 >, abstract free to all.

Mallow, J.V. 1996. "Science Anxiety Reduction: A Lecture/Workshop." GASAT 8: 849-855; online at < http://archive.wigsat.org/gasat/papers1/23.txt >. See GASAT#8 (1996).

Mallow, J.V. 1998. "Student Attitudes and Enrollments in Physics, with Emphasis on Gender, Nationality, and Science Anxiety," in J.H. Jensen, M. Niss, and T. Wedege, T., eds., *Justification and Enrollment Problems in Education Involving Mathematics or Physics*, Roskilde U. Press, Roskilde, DK: 237-258.

Mallow, J.V. & R.R. Hake. 2002. *Gender Issues in Physics/Science Education (GIPSE) - Some Annotated References*, online at < http://www.physics.indiana.edu/~hake/GIPSE-4b.pdf > (232kB).

This is the earlier version of the present document. It contains about 300 references and 200 hot-linked URL's. It will be left on the web with a note under the title: "PLEASE SEE THE 2008 UPDATE *Gender Issues in Science/Math Education (GISME)* at < http://www.luc.edu/physics/faculty/mallow.shtml > and as. ref. 55 at < http://www.physics.indiana.edu/~hake/ >.

Mallow, J.V. 2006. "Science Anxiety: Research and Action," in *Handbook of College Science Teaching*, ed, by J.J. Mintzes & W.H. Leonard, NSTA Press. pp. 3-14. Amazon.com information at < http://tinyurl.com/2c3tru >. A Google "book preview" is online at < http://tinyurl.com/24tc9n >.

#CE #CS *Mallow, J.V. 2007 "Constructivism in Physics Education – Philosophically Problematic, but Pedagogically Successful," AGORA Journal of Research, Development, and Concept Exchange in the Professions, online at < http://www.cvustork.dk/filer/agora106constructivisminphysicseducation.pdf > (148 kB).

#EB *Marchese, T.J. 1997. "The New Conversations About Learning: Insights From Neuroscience and Anthropology, Cognitive Science and Workplace Studies," *Assessing Impact: Evidence and Action*, American Association for Higher Education (now defunct), Washington DC, pp. 79-95, online at < http://www.newhorizons.org/lifelong/higher_ed/marchese.htm >.

Margolis, J. & A. Fisher. 2003. *Unlocking the Clubhouse: Women in Computing*. Amazon.com information at < http://tinyurl.com/2wxgyc >. Note the "Search Inside" feature.

#FSC Markowitz, D. 2000. "My Opinion - Others May Differ: Who Wears Pythagoras' Trousers?" *APS News*, March; online (for APS members) at < http://www.aps.org/publications/apsnews/200003/markowitz.cfm >. Markowitz wrote :

> "The book is *Pythagoras' Trousers*: *God, Physics, and the Gender Wars*. . . . (Werthheim 1997). . . The title reminds us that Pythagoras and his followers combined natural and supernatural studies. They originated the idea God is a mathematician, an idea that still has currency. The author covers much of the history of Western science, religion, and society, and she does so with a deft hand. Her main points are that women have been deliberately excluded from the highest callings of the mind, encompassing both science and religion, and that the persistence of this situation bodes ill for science, for society, and for women. In the introductory chapter Wertheim zooms in on the most egregious religion and the most offending science by saying: 'Physics is thus the Catholic Church of science'. . . .' A good deal of Wertheim's argument is that male physics and female physics are different, and, being different, it would be beneficial to have both. It is a yin/yang kind of thing. But is it so?"

Marshall, J. 1997. "The Effect of Introducing Biographical Material on Women Scientists into the Introductory Physics Curriculum." *Journal of Women and Minorities in Science and Engineering* **3**(4).

Marzabadi, C.H., V.J. Kuck, S.A. Nolan, and J.P. Buckner, eds. 2006. *Are Women Achieving Equity in Chemistry? Dissolving Disparity and Catalyzing Change*. American Chemical Society and Oxford University Press, publisher's information at < http://www.oup.com/us/catalog/general/subject/Chemistry/?view=usa&ci=9780841239500 >.

> For a review see "Women in STEM Careers" [Reilly (2007b)].

#CE #CS *Matthews, M.R. 1998. *Constructivism in Science Education: A Philosophical Examination*. Kluwer. Amazon.com information at < http://tinyurl.com/6pq48r >. Note the "Search Inside" feature. A Google "book preview is online at < http://tinyurl.com/5w54hy >.

#CE #CS *Matthews, M.R. 2002. "Constructivism and Science Education: A Further Appraisal," *J. Sci. Educ. and Technol.* **11**(2): 121-134; abstract online at < http://www.springerlink.com/content/6mp7mbtl9b0q9q7a/ >. The abstract reads:

> "This paper is critical of constructivism. It examines the philosophical underpinnings of the theory, it outlines the impact of the doctrine on contemporary science education, it details the relativist and subjectivist interpretation of Thomas Kuhn's work found in constructivist writings, it indicates the problems that constructivist theory places in the way of teaching the content of science, and finally it suggests that a lot of old-fashioned, perfectly reasonable educational truisms and concepts are needlessly cloaked in constructivist jargon that inhibits communication with educationalists and policy makers."

Matyas, M.L. & L.S. Dix, eds. 1992. *Science and Engineering Programs: On Target for Women?*" National Academies Press; online at < http://www.nap.edu/catalog/2039.html >.

Mazur, E. 2008. "A Female Friendly Classroom?" online at < http://mazur-www.harvard.edu/research/detailspage.php?rowid=9 >. Mazur wrote:

> "Can pedagogy alleviate the well-known 'gender gap' in performance and representation in the physical sciences? Peer Instruction provides a cooperative learning environment and challenges every student to think during class. These two qualities are thought to promote success of female students. We are studying whether female students indeed succeed on a par with male students in introductory physics taught with Peer Instruction."

McArdle, E. 2008. "The freedom to say 'no': Why aren't there more women in science and engineering? Controversial new research suggests: They just aren't interested," *Boston Globe*, 18 May; online at < http://tinyurl.com/6bkg3g >. We thank Paul Hickman for calling our attention to this reference. McArdle wrote [our inserts at ". . . .[insert]. . . ."]:

> "When it comes to the huge and persistent gender gap in science and technology jobs, the finger of blame has pointed in many directions: sexist companies, boy-friendly science and math classes, differences in aptitude. Women make up almost half of today's workforce, yet hold just a fraction of the jobs in certain high-earning, high-qualification fields. They constitute 20 percent of the nation's engineers, fewer than one-third of chemists, and only about a quarter of computer and math professionals. Over the past decade and more, scores of conferences, studies, and government hearings have been directed at understanding the gap. It has stayed in the media spotlight thanks in part to the high-profile misstep of then-Harvard president Larry Summers, whose loose comment at a Harvard conference on the topic in 2005 ultimately cost him his job. Now two new studies by economists . . . . [Rosenbloom *et al*. (in press)]. . . . and social scientists . . . .[evidently referring to Susan Pinker (2008)]. . . have reached a perhaps startling conclusion: An important part of the explanation for the gender gap, they are finding, are the preferences of women themselves. *When it comes to certain math- and science-related jobs, substantial numbers of women - highly qualified for the work - stay out of those careers because they would simply rather do something else*." [Our *italics*.]

*McCray, R.A., R.L. DeHaan, J.A. Schuck, eds. 2003. *Improving Undergraduate Instruction in Science, Technology, Engineering, and Mathematics: Report of a Workshop,* Committee on Undergraduate STEM Instruction, National Research Council, National Academy Press; online at < http://www.nap.edu/catalog/10711.html >. Inexplicably, this report essentially ignored the landmark research of Halloun & Hestenes (1985a,b) and the pre/post testing of introductory physics-course learning gains which it initiated.

McCullough, L.E. 2001. "Does Learning Come in Pink and Blue? Gender and Learning," Physics Education Research Conference, Rochester; online at < http://physics.uwstout.edu/staff/mccullough/PERCJul01GenderLearn.pdf > (28 kB).

McCullough, L. & D.E. Meltzer. 2001. "Differences in male/female response patterns on alternative-format versions of FCI items," *Proceedings of the Physics Education Research Conference*, Rochester, New York, July 25-26, edited by Scott Franklin, Jeffrey Marx, and Karen Cummings pp. 103-106; online at < http://www.physicseducation.net/docs/ref5.pdf > (268 kB).

#FSP McCullough, L. 2002. "Women in Physics: A Review," *The Physics Teacher* **40**(2): 86-91, online at to subscribers at
< http://scitation.aip.org/dbt/dbt.jsp?KEY=PHTEAH&Volume=40&Issue=2 >.
McCullough wrote:

> "The widely used *Force Concept Inventory*. . . .[our insert - Hestenes *et al*. (1992)]. . . mentions rockets, hockey pucks, and cannon balls, contexts with which men are typically more comfortable than women. These male oriented contexts may be negatively affecting women's scores . . . Researchers studying the theoretical underpinnings of the nature of science itself [Keller 1985, Bleier 1988, Schiebinger 1999] suggest that *the very nature of science itself and the scientific method is inherently masculine*, which can serve as a barrier to women." (Our *italics*.)
>
> For commentary on Keller (1985) see, e.g., *What Makes Nature Tick?* [Newton (1997, pages 27 and 209)], and the index entries for "Keller" in *A House Built on Sand: Exposing Postmodern Myths About Science* [Koertge (1998)]. For commentary on Schiebinger (1999) see e.g., index entries for "Schiebinger" Koertge (1998)].

#FSP McCullough, L. 2004. "Gender, Context, and Physics Assessment," *Journal of International Women's Studies, Special Issue: Women in Science* **5**(4), May; online at
< http://www.bridgew.edu/SoAS/jiws/May04_Special/Gender.pdf > (92 kB). McCullough wrote:

> "The issues surrounding women and science have been much discussed over the last few decades. These discussions have taken many forms. One branch has been the dialogue about the masculine nature of science and how that has affected women's participation in science and the growth of science itself. Londa Schiebinger (1999) gathers much of this debate together in her book "Has Feminism Changed Science?" Science, particularly the 'hard' sciences such as chemistry and physics, are typically thought of as being objective, unbiased. Historically, it has not been considered that who does the science might affect the science itself. Yet Schiebinger, Evelyn Fox Keller, and others suggest that this is not the case. Throughout history women have been excluded from science via many different means. The lack of women in science has led to masculine theories and interpretations."

McCullough, L. & A. Krieger. 2004. "A Census of the Physics Education Research Community," a Report; online at < http://physics.uwstout.edu/staff/mccullough/PERcensus.pdf > (48 kB).

McDermott. M. 2005. "Women, Gender and Science," online at
< http://www.gustavus.edu/~mmcdermo/women-science-links.html >. Contains listings of Profiles/Biographies, Documents, Databases/Links, Bibliographies, Syllabi, Organizations, Programs/Sites for Girls/Women, & Miscellaneous.

#SSIGD McDonnell, F. 2005. "Why so few choose physics: An alternative explanation for the leaky pipeline," *Am. J. Phys.* **73**(7): 583-586, online at < http://www.warren-wilson.edu/~physics/FacultyInterest/AJP000583.pdf > (152 kB).
McDonnell wrote:

> "Recent remarks by Harvard University President Lawrence Summers have sparked controversy. However, the notion that the 'very substantial under-representation' of women in physics is explained by the 'intrinsic' deficiencies of 'available aptitude' is hardly novel. Indeed, as recently as 1990, in a piece titled 'Women—why so few?,' Professor Michael Levin (1990) argued that innate cognitive gender differences between the sexes make gender equity in physics both an unrealistic and perhaps undesirable reality. According to the cognitive difference model, the disproportionate loss of women—and by extension, any group not currently represented in the field—is explained in terms of innate differences in ability, most notably differences in mathematical aptitude: those with aptitude in mathematics (mostly men) continue in physics, while those lacking mathematical aptitude (mostly women) switch to other fields. Yet, the question of innate differences is far from resolved. Studies reported by Mary Beth Ruskai (1991) in her response to Michael Levin and more recent studies reported by David C. Geary (1998) and Yu and Kimberlee A. Shauman (2005) make it clear that any differences that may exist between the sexes are small, appear to be responsive to instruction, are restricted to specific areas of mathematics, and pale in light of differences across cultures."

McDonnell concludes:

> "As Gerhard Sonnert (1999b) has noted, 'If the structural and cultural causes for the leaks are ignored, attempts at increasing the representation of women at the various pipeline segments may fall short.' By taking seriously the instructional and socio-cultural aspects of physics teaching, and by providing opportunities for what David Layzer. . . .[our insert - Harvard Emeritus Professor of Astrophysics, in a piece titled "Why women (and men!) give up on science" in *On Teaching and Learning*, a journal of the Derek Bok Center, Harvard University, May 1992, pp. 67–77]. . . . describes as 'invention and ingenuity,'especially during the early junctures of the academic pipeline, students might form a more inclusive view of physics and physicists, and the physical sciences might appeal to a wider diversity of students."

McGrayne, S.B. 2001. *Nobel Prize Women in Science: Their Lives, Struggles, and Momentous Discoveries*, Second Edition. Joseph Henry Press. For information see Sharon McGrayne's site at < http://www.mcgrayne.com/book2.html >.

#DM McKellar, D. 2007. *Math Doesn't Suck: How to Survive Middle-School Math Without Losing Your Mind or Breaking a Nail*. Hudson Street Press. Amazon.com information at < http://tinyurl.com/yrtxgd >. Note the "Search Inside" feature.

#LPE *McKibben, B. 2006. *The End of Nature*. Random House. Amazon.com information at < http://tinyurl.com/6k7fum >:

> "Whatever we once thought Nature was--wildness, God, a simple place free from human thumbprints, or an intricate machinery sustaining life on Earth--we have now given it a kick that will change it forever. Humanity has stepped across a threshold. In his free-ranging and provocative book, Bill McKibben explores the philosophies and technologies that have brought us here, and he shows how final a crossing we have made." -- James Gleick, author of *Chaos*

#LPE *McKibben, B. 2008a. "Civilization's last chance: The planet is at a tipping point on climate change, and it gets much worse, fast," *Los Angeles Times*, 11 May; online at < http://www.latimes.com/news/opinion/la-op-mckibben11-2008may11,0,7434369.story >. McKibben wrote:

". . . . .all of a sudden, those grim Club of Rome types who, way back in the 1970s, went on and on about the "limits to growth" suddenly seem ... how best to put it, RIGHT (emphasis in the original).

All of a sudden it isn't morning in America, it's dusk on planet Earth.

There's a number -- a new number -- that makes point most powerfully. It may now be the most important number on Earth: 350. As in parts per million of carbon dioxide in the atmosphere.

A few weeks ago, NASA's chief climatologist, James Hansen, submitted a paper to *Science* magazine with several coauthors. The abstract attached to it argued -- and I have never read stronger language in a scientific paper -- that "*if humanity wishes to preserve a planet similar to that on which civilization developed and to which life on earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO_2 will need to be reduced from its current 385 ppm to at most 350 ppm.*" [Our *italics*.]

See also McKibben's website < http://www.350.org/4/ >.

#LPE *McKibben, B. 2008b. *Deep Economy: The Wealth of Communities and the Durable Future*. Holt Paperbacks. We thank Art Hobson, list manager of PHYSOC < http://listserv.uark.edu/archives/physoc.html >, for calling our attention to this book. Amazon.com information at < http://tinyurl.com/5yt7m4 >:

"Beginning with his prescient treatise on global warming, *The End of Nature* (1990), McKibben has been investigating and elucidating some of the most confounding aspects of our lives. He now brings his signature clarity of thought and handsomely crafted prose to a pivotal, complicated subject, the negative consequences of our growth-oriented economy. McKibben incisively interprets a staggering array of studies that document the symbiotic relationship between fossil fuels and five decades of dizzying economic growth, and the many ways the pursuit of ever-higher corporate profits has led to environmental havoc and neglect of people's most basic needs. At once reportorial, philosophic, and anecdotal, McKibben, intoning the mantra 'more is not better,' takes measure of diminishing returns. With eroding security, a dysfunctional health system, floundering public schools, higher rates of depression, 'wild inequity' in the distribution of wealth, and damage to the biosphere, McKibben believes a new paradigm is needed, that of a 'deep economy' born of sustainable and sustaining communities anchored in local resources. Using the farmer's market as a template, he explains the logistics of workable alternatives to the corporate imperative based on ecological capacities and the 'economics of neighborliness.' With the threat of energy crises and global warming, McKibben's vision of nurturing communities rooted in traditional values and driven by 'green' technologies, however utopian, may provide ideas for constructive change."

– Donna Seaman, American Library Association.

*Meltzer, D.E. 2002. "The relationship between mathematics preparation and conceptual learning gains in physics: A possible 'hidden variable' in diagnostic pretest scores," *Am. J. Phys.* **70**(12): 1259-1268; online at < http://www.physicseducation.net/docs/AJP-Dec-2002-Vol.70-1259-1268.pdf > (260 kB).

See also the addendum "Normalized Learning Gain: A Key Measure Of Student Learning" at < http://www.physicseducation.net/docs/Addendum_on_normalized_gain.pdf > (156 kB).

*Meltzer, D.E. & K. Manivannan. 2002. "Transforming the lecture-hall environment: The fully interactive physics lecture,"*Am. J. Phys.* 70(6): 639-654; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=70&Issue=6 >. The abstract reads, in part :

> ". . .We report on seven years of development and testing of a variant of Peer Instruction as pioneered by Mazur that aims at achieving virtually continuous instructor – student interaction through a 'fully interactive' physics lecture. . . . We also discuss a variety of assessment data that indicate strong gains in student learning, consistent with other researchers. We conclude that interactive-lecture methods in physics instruction are practical, effective, and amenable to widespread implementation."

*Meltzer, D.E. 2006a. "Links to United States Physics Education Research Groups," online at < http://www.physicseducation.net/links/index.html >.

Mentor Net. 2002. "The E-Mentoring Network for Women in Engineering and Science"; online at < http://www.mentornet.net/ > :

> MentorNet is the award-winning nonprofit e-mentoring network that positively affects the retention and success of those in engineering, science and mathematics, particularly but not exclusively women and others underrepresented in these fields. Founded in 1997, MentorNet provides highly motivated protégés from many of the world's top colleges and universities with positive, one-on-one, email-based mentoring relationships with mentors from industry, government, and higher education. In addition, the MentorNet Community provides opportunities to connect with others from around the world who are interested in diversifying engineering and science.

Merton, R.K. 1968. "The Matthew Effect in Science: The reward and communication systems of science are considered," *Science* 159 (3810):56-63; online at < http://garfield.library.upenn.edu/merton/matthew1.pdf > (2.5 MB). [After Matthew, *First Gospel of the New Testament* (Gutenberg edition) " . .to him that hath shall be given, but from him that hath not shall be taken away even that which he hath."] This article is also reprinted in Merton (1973), pp. 439-459.

> Consideration of the role of the Matthew Effect in gender disparity is not uncommon and has increased by a factor of 28 during the period July 2002 to March 2008, as judged from hits (with the quotes but without the square brackets) on Google's search engine at < http://www.google.com/ > :

	IN JULY 2002	IN MARCH 2008	2008/2002
["Matthew Effect" Women]	223	6240	28
["Matthew Effect" gender]	---	4820	---
"Matilda effect"	---	620	---

> According to < http://en.wikipedia.org/wiki/Matthew_effect > "The Matilda effect" is the corollary to the Matthew effect: the work of women in science < http://en.wikipedia.org/wiki/Women_in_science > is often neglected. The Matilda effect, named after early feminist Matilda Joslyn Gage < http://en.wikipedia.org/wiki/Matilda_Joslyn_Gage >, was postulated by historian of science Margaret Rossiter (1993) in "The Matthew Matilda Effect in Science" [Rossiter (1993)].

*Merton, R.K. 1973. *The Sociology of Science: Theoretical and Empirical Investigations*, Univ. of Chicago Press, publisher's information at < http://www.press.uchicago.edu/cgi-bin/hfs.cgi/00/15787.ctl >. See especially pp. 439-459 on the "Matthew Effect in Science."

*Merton, R.K. 1988. "The Matthew Effect in Science, II: Cumulative advantage and the symbolism of intellectual property" *ISIS* 79: 606-623; online < http://garfield.library.upenn.edu/merton/matthewii.pdf > (2.2 MB).

*Merton, R.K. 1995."The Thomas Theorem and The Matthew Effect" *Social Forces* **74**(2): 379-424; online at < http://garfield.library.upenn.edu/merton/thomastheorem.pdf > (3.4 MB).

*Mervis, J. 2006. "U.S. Mathematics Education: Well-Balanced Panel to Tackle Algebra Reform," *Science* **312**: 982; online to subscribers at < http://www.sciencemag.org/cgi/content/summary/312/5776/982a?rss=1 >.

Mervis, J. 2007. "U.S. National Medals: For Men Only?" *Science* **316**(5832):1683, summary online at < http://tinyurl.com/5aeuu7 > :

> For the first time in 4 years, the honorees of the 2006 National Medal of Science will include a woman. That's a terrible record, say advocates of greater diversity in science, and sends a disturbing message about who is capable of doing world-class science.

#IE *Michael, J. 2006. "Where's the evidence that active learning works?" *Advances in Physiology Education* **30**: 159-167, online at <http://advan.physiology.org/cgi/content/full/30/4/159 - T1>. A masterful review by a medical-education researcher/developer.

MIT MIT. 1999. "A Study on the Status of Women Faculty at MIT," MIT Faculty Newsletter **XI** (4), March; online at < http://web.mit.edu/fnl/women/women.html >.

#SDMA Monastersky, R. 2005. Women and Science: The Debate Goes On: Primed for Numbers – Are boys better at math? Experts try to divide the influences of nature and nurture." *Chronicle of Higher Education* **51**(26): A1, 4 March; online at < http://chronicle.com/free/v51/i26/26a00102.htm >. Monastersky writes:

> "Data from [Julian Stanley's] program, at Johns Hopkins, shows just how strong the cultural factors are in determining math achievement. In the early 1980s, he and [Camilla Benbow] reported. . . [Benbow & Stanley (1980)]. . . . a whopping disparity in the numbers of mathematically gifted boys and girls who scored 700 on the math section of the SAT at the age of 13, a distinction achieved by one in 10,000 students. *A quarter-century ago, there were 13 boys for every girl at that level. Now the ratio is only 2.8 to 1, a precipitous drop that has not been reported in the news media*. [Our *italics*.] 'It's gone way down as women have had an opportunity to take their math earlier,' says Mr. Stanley."

*Morrison, R.T. 1986. "The Lecture System in Teaching Science," in *Proceedings of the Chicago Conferences on Liberal Education*, Number 1, Undergraduate Education in Chemistry and Physics (edited by Marian R. Rice). The College Center for Curricular Thought: The University of Chicago, 18-19 October 1986; online at < http://www.entropysite.com/morrison.html >. See also "In Defense of Lecturing" [Burgan (2006)].

Morse, M. 1995. *Women changing science: voices from a field in transition*. Plenum. Amazon.com information at < http://tinyurl.com/6lhku2 >. Note the "Search Inside" feature. A Google "book preview" is online at < http://tinyurl.com/6x3pp5 >.

*Mulford, D. R & W.R. Robinson. 2002. "An inventory for alternate conceptions among first semester general chemistry students," *J. Chem. Educ*. **79**: 739-744; abstract online at < http://jchemed.chem.wisc.edu/Journal/Issues/2002/Jun/abs739.html >.

Murphy, P.F. & C.V. Gipps, eds., 1996. *Equity in the Classroom: Towards Effective Pedagogy for Girls and Boys*. Routledge; publishers information at < http://tinyurl.com/384o53 >. A Goggle "book preview" is online at < http://tinyurl.com/2lcpqp >.

Murray, M.A.M. 2001. *Women Becoming Mathematicians: Creating a Professional Identity in Post–World War II America*. MIT Press. publisher's information at < http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=8548 >. Amazon.com information at < http://tinyurl.com/2tytxz >. Note the "Search Inside" feature.

"This book is not only an insightful and useful study of women in mathematics--it is a page-turner. As thirty-six women mathematicians come alive in these pages, Margaret A. M. Murray destroys the myth of the cloistered mathematical life, and implicitly challenges us to find a new mythology that works for the next century. I couldn't put it down." -- Howard Georgi, Mallinckrodt Professor of Physics, Harvard University, and Former Co-chair, Committee on Women in Science and Engineering, National Research Council.

National Academies. 2008. "Gender Differences in Careers of Science, Engineering, and Mathematics Faculty," gender equity studies by States; online at < http://www7.nationalacademies.org/cwse/gender_faculty_links.html >.

*NAAL. 2008. National Academy of Academic Leadership, online at < http://thenationalacademy.org/ >. See the Site Map at < http://thenationalacademy.org/sitemap.html >, especially:

a. Learners and Learning - Readings & Websites
< http://thenationalacademy.org/resources/learning.html >
b. Curriculum, Course and Program Design, and Assessment Readings & Websites
< http://www.thenationalacademy.org/resources/curriculum.html >.
c. Assessment and evaluation in higher education: Some concepts and principles
< http://thenationalacademy.org/readings/assessandeval.html >
d. Assessment Readings & Websites
< http://thenationalacademy.org/resources/assess.html >

*National Academy [of Science (NAS), of Engineering (NAE), Institute of Medicine, National Research Council (NRC). 2002. Online at < http://www.nationalacademies.org/ >. See especially:

"Education" < http://www7.nationalacademies.org/dbasse/Education.html >;
"Center for Education" < http://www7.nationalacademies.org/cfe/ >;
"National Academy Press" (NAP) Education Collection (read online FREE!)
< http://www.nap.edu/topics.php?topic=282 >.

NAE. 2002. National Academy of Engineering. *Engineer Girl!* Website
< http://www.engineergirl.org/ >.
Find out more about engineering careers < http://www.engineergirl.org/?id=9391 >.
Read profiles of women engineers < http://www.engineergirl.org/?id=9392 >.
Find out what classes to take in high school to pursue an engineering careers
< http://www.engineergirl.org/?id=9393 >.

NAP. 1986. National Academy Press. *Computer Chips and Paper Clips: Technology and Women's Employment, Volume I*; online at
< http://www.nap.edu/catalog.php?record_id=924#description > :
"Drawing on the historical changes in five areas—the jobs of telephone operators, workers in the printing and publishing industries, information and data processors, retail clerks, and nurses—this volume offers a comprehensive examination of how microelectronics and telecommunications have affected women's work and their working environments and looks ahead to what can be expected for women workers in the next decade. It also offers perspectives on how workers can more easily adapt to the changing workplace and addresses the controversial topic of job insecurity as a result of an influx of advanced electronic systems."

NAP. 1987. National Academy Press. *Computer Chips and Paper Clips: Technology and Women's Employment, Volume II: Case Studies and Policy Perspectives*; online at
< http://www.nap.edu/catalog.php?record_id=951 > :
"This companion to Volume I presents individually authored papers covering the history, economics, and sociology of women's work and the computer revolution. Topics include the implications for equal employment opportunity in light of new technologies; a case study of the insurance industry and of women in computer-related occupations; a study of temporary, part-time, and at-home employment; and education and retraining opportunities."

NAP. 1991. National Academy Press. *Women in Science and Engineering: Increasing Their Numbers in the 1990s: A Statement on Policy and Strategy*; online at
< http://www.nap.edu/catalog.php?record_id=1878 > :
"From time to time, it is necessary to alert the research and policy communities to opportunities for action in areas of mutual concern. One such area is the participation and utilization of women in science and engineering in the United States. This book explores the underparticipation of women in these fields and presents a strategic plan to bring qualified women into such careers as researchers, teachers, and practitioners of science and engineering."

NAP. 1994. National Academy Press, *Women Scientists and Engineers Employed in Industry: Why So Few?*; online at < http://www.nap.edu/catalog.php?record_id=2264 > :
"This book, based on a conference, examines both quantitative and qualitative evidence regarding the low employment of women scientists and engineers in the industrial work force of the United States, as well as corporate responses to this underparticipation. It addresses the statistics underlying the question 'Why so few?' and assesses issues related to the working environment and attrition of women professionals."

NAP. 1997. National Academy Press, *Adviser, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering*; online at < http://www.nap.edu/catalog.php?record_id=5789 > :

"This guide offers helpful advice on how teachers, administrators, and career advisers in science and engineering can become better mentors to their students. It starts with the premise that a successful mentor guides students in a variety of ways: by helping them get the most from their educational experience, by introducing them to and making them comfortable with a specific disciplinary culture, and by offering assistance with the search for suitable employment. Other topics covered in the guide include career planning, time management, writing development, and responsible scientific conduct. Also included is a valuable list of bibliographical and Internet resources on mentoring and related topics."

*NAP. 1999a. National Academy Press. *How People Learn: Bridging Research and Practice*, online at < http://www.nap.edu/catalog.php?record_id=9457 >. From the executive summary:

"In December 1998, the National Research Council released *How People Learn*, a report that synthesizes research on human learning. . . . .[‡our insert – see Bransford *et al*. (2000)]. . . . The research put forward in the report has important implications for how our society educates: for the design of curricula, instruction, assessments, and learning environments. The U.S. Department of Education's Office of Educational Research and Improvement (OERI), which funded *How People Learn*, has posed the next question: What research and development could help incorporate the insights from the report into classroom practice? Responding to that question is the focus of this report."

NAP. 2000a. National Academy Press. Committee on Women in Science and Engineering. *Who Will Do the Science of the Future? A Symposium on Careers of Women in Science*; online at < http://www.nap.edu/catalog.php?record_id=10008 >. See especially the contributions by Lederman (2000), Georgi (2000c), and Dresselhaus (2000) to this symposium:

"Who Will Do the Science of the Future? is the summary of a symposium on careers of women in science. The symposium incorporated three panels of presenters: one focusing on the next generation, Science for All Students; a second that looks in depth at the issues reflected in one particular field of science, computer science, reflecting an in-depth view of academic and industrial computer scientists; and a third that focuses on strategies and policies to recruit, retain, and promote career advancement for women scientists. Lastly, there was a plenary address on how to ensure women continue to advance into positions of leadership in science."

NAP. 2000b. National Academy Press. *Women in the Chemical Workforce: A Workshop Report to the Chemical Sciences Roundtable*; online at
< http://www.nap.edu/catalog.php?record_id=10047 >. From the Summary
< http://books.nap.edu/openbook.php?record_id=10047&page=1 > :

"In the fields of science and engineering, women are not represented in proportion to their fraction in the U.S. population. This under representation is especially pronounced in academic departments, where hiring of women lags far behind their representation in the pool of doctoral degree holders. Furthermore, women apparently do not ascend the career ladder as fast or as far as their male counterparts. Recent reports [*Ensuring a Strong U.S. Scientific, Technical, and Engineering Workforce in the 21st Century* OSTP (2000); *Land of Plenty: Diversity As America's Competitive Edge in Science, Engineering and Technology* [CAWMSET (2000)] elaborate on the impact of this and related issues for science, the academic enterprise, the U.S. economy, and global economic competitiveness. The Chemical Sciences Roundtable judged that the demographics of the workforce and the implications for science and society vary, depending on the field of science or engineering. Accordingly, it organized a workshop, 'Women in the Chemical Workforce,' to address issues pertinent to the chemical and chemical engineering workforce as a whole, with an emphasis on the advancement of women. Each of the workshop's three sessions—Context and Overview, Opportunities for Change, and Conditions for Success—included, in addition to presentations by invited speakers, discussion within breakout groups and an oral report from each group."

NAP. 2001. *From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers*. National Academy Press; online at
< http://books.nap.edu/catalog.php?record_id=5363 > :

"Although women have made important inroads in science and engineering since the early 1970s, their progress in these fields has stalled over the past several years. This study looks at women in science and engineering careers in the 1970s and 1980s, documenting differences in career outcomes between men and women and between women of different races and ethnic backgrounds."

NAP. 2002. National Academy Press. *Achieving XXcellence in Science: Role of Professional Societies in Advancing Women in Science: Proceedings of a Workshop*; online at
< http://www.nap.edu/catalog.php?record_id=10964 > :

"This report is the proceedings of a July 2002 workshop of the Committee on AXXS 2002: A Workshop for Clinical Societies to Enhance Women's Contributions to Science and their Profession. The workshop gathered representatives of clinical societies and identified ways to enhance the participation of women scientists in the clinical research workforce. This workshop was a follow-up to the AXXS 1999 conference sponsored by the Office of Research on Women's Health (ORWH) at the National Institutes of Health (NIH), which focused on how scientific societies could contribute to the enhancement of women's careers in science."

NAP. 2006a. National Academy Press. *Biological, Social, and Organizational Components of Success for Women in Academic Science and Engineering: Workshop Report*; online at < http://www.nap.edu/catalog.php?record_id=11766 > :

> "During the last 40 years, the number of women studying science and engineering (S&E) has increased dramatically. Nevertheless, women do not hold academic faculty positions in numbers that commensurate with their increasing share of the S&E talent pool. The discrepancy exists at both the junior and senior faculty levels. In December 2005, the National Research Council held a workshop to explore these issues. Experts in a number of disciplines met to address what sex-differences research tells us about capability, behavior, career decisions, and achievement; the role of organizational structures and institutional policy; cross-cutting issues of race and ethnicity; key research needs and experimental paradigms and tools; and the ramifications of their research for policy, particularly for evaluating current and potential academic faculty. *Biological, Social, and Organizational Components of Success for Women in Academic Science and Engineering* consists of three elements: an introduction, summaries of panel discussions including public comment sessions, and poster abstracts."

NAP. 2006b. National Academy Press. *Women's Adventures In Science Series*; online at < http://www.nap.edu/catalog/was/ >. The NAP wrote:

> What would it be like to build the first robot that could interact with people? Or to study human remains in search of criminal evidence? In Women's Adventures in Science, readers will learn about the trailblazing women who are leaders in a variety of scientific fields, from robotics to forensics. Each book focuses on the life and work of a woman active in her field today, providing readers with insights into the personal and professional paths that led to their careers in science. The companion Web site, < http://www.iwaswondering.org/ >, offers another way to "meet" these inspiring women scientists. The fun, interactive site builds on the content of the books and includes games, comic strips, videos, activities, and a timeline of women in science.
>
> Learn about the lives and work of women who are making exciting contributions to a variety of fields of science, from astronomy to forensics to physics.
>
> 1. Beyond Jupiter: The Story of Planetary Astronomer Heidi Hammel
> 2. Bone Detective: The Story of Forensic Anthropologist Diane France
> 3. Forecast Earth: The Story of Climate Scientist Inez Fung
> 4. Gene Hunter: The Story of Neuropsychologist Nancy Wexler
> 5. Gorilla Mountain: The Story of Wildlife Biologist Amy Vedde
> 6. Nature's Machines: The Story of Biomechanist Mimi Koehl
> 7. People Person: The Story of Sociologist Marta Tienda
> 8. Robo World: The Story of Robot Designer Cynthia Breazeal
> 9. Space Rocks: The Story of Planetary Geologist Adriana Ocampo
> 10. Strong Force: The Story of Physicist Shirley Ann Jackson
>
> For a review of the *Women's Adventures In Science Series* see Nostrand & Lee (2007).

NAP. 2006c. National Academy Press. *To Recruit and Advance: Women Students and Faculty in Science and Engineering;* online at < http://www.nap.edu/catalog.php?record_id=11624 > :

"Although more women than men participate in higher education in the United States, the same is not true when it comes to pursuing careers in science and engineering. *To Recruit and Advance: Women Students and Faculty in Science and Engineering* identifies and discusses better practices for recruitment, retention, and promotion for women scientists and engineers in academia. Seeking to move beyond yet another catalog of challenges facing the advancement of women in academic science and engineering, this book describes actions actually taken by universities to improve the situation for women. Serving as a guide, it examines the following:

a. Recruitment of female undergraduates and graduate students.
b. Ways of reducing attrition in science and engineering degree programs in the early undergraduate years.
c. Improving retention rates of women at critical transition points from undergraduate to graduate student, from graduate student to postdoc, from postdoc to first faculty position.
d. Recruitment of women for tenure-track positions.
e. Increasing the tenure rate for women faculty.
f. Increasing the number of women in administrative positions.

This guide offers numerous solutions that may be of use to other universities and colleges and will be an essential resource for anyone interested in improving the position of women students, faculty, deans, provosts, and presidents in science and engineering."

#EC NAP. 2007a. National Academy Press, Committee on Maximizing the Potential of Women in Academic Science and Engineering, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Beyond Bias and Barriers: Fulfilling the Women in Academic Science and Engineering*, online at < http://www.nap.edu/catalog/11741.html > :

"The United States economy relies on the productivity, entrepreneurship, and creativity of its people. *To maintain its scientific and engineering leadership amid increasing economic and educational globalization, the United States must aggressively pursue the innovative capacity of all its people—women and men*. [Our *italics*.] However, women face barriers to success in every field of science and engineering; obstacles that deprive the country of an important source of talent. Without a transformation of academic institutions to tackle such barriers, the future vitality of the U.S. research base and economy are in jeopardy. *Beyond Bias and Barriers* explains that eliminating gender bias in academia requires immediate overarching reform, including decisive action by university administrators, professional societies, federal funding agencies and foundations, government agencies, and Congress. If implemented and coordinated across public, private, and government sectors, the recommended actions will help to improve workplace environments for all employees *while strengthening the foundations of America's competitiveness*."[Our *italics*.]

#EC *NAP. 2007b. Committee on Science, Engineering, and Public Policy, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Future*," National Academies Press; online at < http://books.nap.edu/catalog/11463.html > :

"In a world where advanced knowledge is widespread and low-cost labor is readily available, U.S. advantages in the marketplace and in science and technology have begun to erode. A comprehensive and coordinated federal effort is urgently needed to bolster U.S. competitiveness and pre-eminence in these areas. This congressionally requested report by a pre-eminent committee makes four recommendations along with 20 implementation actions that federal policy-makers should take to create high-quality jobs and focus new science and technology efforts on meeting the nation's needs, especially in the area of clean, affordable energy: 1) Increase America's talent pool by vastly improving K-12 mathematics and science education; 2) Sustain and strengthen the nation's commitment to long-term basic research; 3) Develop, recruit, and retain top students, scientists, and engineers from both the U.S. and abroad; and 4) Ensure that the United States is the premier place in the world for innovation. Some actions will involve changing existing laws, while others will require financial support that would come from reallocating existing budgets or increasing them. *Rising Above the Gathering Storm* will be of great interest to federal and state government agencies, educators and schools, public decision makers, research sponsors, regulatory analysts, and scholars.

But should economic competitiveness be the *primary* imperative for education reform as stressed in the above report and reiterated by Brakke (2006) and Gordon (2007)? As indicated in "Can Scientific Research Enhance the Art of Teaching?" [Hake (2007f)]:

"Although international competitiveness is often cited by educational leaders, politicians, and business executives, more crucial in my view is the need to overcome the monumental problems now *threatening life on planet Earth*."

NAP. 2008. National Academy Press, Committee on Gender Differences in the Careers of Science, Engineering, and Mathematics Faculty, Committee on Women in Science and Engineering, National Research Council, *Assessing Gender Differences in the Careers of Science, Engineering, and Mathematics Faculty*; online at < http://books.nap.edu/catalog.php?record_id=12062 > :

"Assessing Gender Differences in the Careers of Science, Engineering, and Mathematics Faculty presents new and surprising findings about career differences between female and male full-time, tenure-track, and tenured faculty in science, engineering, and mathematics at the nation's top research universities. Much of this congressionally mandated book is based on two unique surveys of faculty and departments at major U.S. research universities in six fields: biology, chemistry, civil engineering, electrical engineering, mathematics, and physics. A departmental survey collected information on departmental policies, recent tenure and promotion cases, and recent hires in almost 500 departments. A faculty survey gathered information from a stratified, random sample of about 1,800 faculty on demographic characteristics, employment experiences, the allocation of institutional resources such as laboratory space, professional activities, and scholarly productivity. This book paints a timely picture of the status of female faculty at top universities, clarifies whether male and female faculty have similar opportunities to advance and succeed in academia, challenges some commonly held views, and poses several questions still in need of answers. This book will be of special interest to university administrators and faculty, graduate students, policy makers, professional and academic societies, federal funding agencies, and others concerned with the vitality of the U.S. research base and economy."

*NCAT. 2008. National Center for Academic Transformation < http://www.thencat.org/ > :
PROGRAMS
State and System Course Redesign: < http://www.thencat.org/system_solutions.htm >,
The Redesign Alliance: < http://www.thencat.org/RA.htm >,
Colleagues Committed: to Redesign (C^2R)
< http://www.thencat.org/RedesignAlliance/DissemProgram.htm >.
RESOURCES
a. New to Course Redesign? < http://www.thencat.org/Rec_Reading.htm >,
b. Course Redesigns: < http://www.thencat.org/PCR/Proj_Discipline_all.html >,
c. Course Redesign Planning Resources:
< http://www.thencat.org/R2R/R2R_Planning_Resources.htm >,
d. The Learning MarketSpace: < http://www.thencat.org/subscribe.htm >,
e. Articles and Monographs: < http://www.thencat.org/articlesmonographs.html >,
f. Common Ground: < http://www.thencat.org/Common_Ground.htm >,
g. Corporate Associates: < http://www.thencat.org/Corp_Assoc.htm >,
h. Staff: < http://www.thencat.org/staff.html >.

NCRW. 2004. National Council for Research on Women. *MISSING: Information About Women's Lives* < http://www.ncrw.org/misinfo/report.pdf > (408 kB).

NCRW. 2006. National Council for Research on Women. *Gains And Gaps: A Look At The World's Women,* information at < http://www.ncrw.org/publications/worlds_women.htm >.

NCRW. 2008. National Council for Research on Women; online at
< http://www.ncrw.org/about/about.htm > :
COUNCIL MISSION: ". . . . The National Council for Research on Women is a network of more than 100 leading U.S. research, advocacy, and policy centers with a growing global reach. The Council harnesses the resources of its network to ensure fully informed debate, policies, and practices to build a more inclusive and equitable world for women and girls."
For publications see at < http://www.ncrw.org/publications/pubs.htm > , prominent publications of the NCRW are Phillips (1998) and Thom (2001); for why the work of women's research is still crucial see < http://www.ncrw.org/about/Why%20Research%20Matters.htm >.

*NCSU. 2008a. "Assessment Instrument Information Page," Physics Education R & D Group, North Carolina State University; online at < http://www.ncsu.edu/per/TestInfo.html >.

*NCSU. 2008b. SCALE-UP Project; online at <http://www.ncsu.edu/per/scaleup.html>
The primary goal of the Student-Centered Activities for Large Enrollment Undergraduate Programs (SCALE-UP) Project is to establish a highly collaborative, hands-on, computer-rich, interactive learning environment for large-enrollment courses.

*NCTM. 2000. National Council of Teachers of Mathematics. *Principles and standards for school mathematics*," information at < http://standards.nctm.org/ >, including 120 day free access to document.

*NCTM. 2006. *Curriculum Focal Points for Mathematics in Prekindergarten through Grade 8*, online at < http://www.nctmmedia.org/cfp/front_matter.pdf#search=%22focal%22 >.

*NCTQ. 2008. National Council on Teacher Quality, "No Common Denominator: The Preparation of Elementary Teachers in Mathematics by America's Education Schools" online at < http://www.nctq.org/p/publications/reports.jsp >; executive summary at < http://www.nctq.org/p/publications/docs/nctq_ttmath_exec_summ_20080626115937.pdf > (2.8 MB); full report at < http://www.nctq.org/p/publications/docs/nctq_ttmath_fullreport_20080626115953.pdf > (3 MB). The summary at < http://www.nctq.org/p/publications/reports.jsp > states:

> "American students' chronically poor performance in mathematics on international tests may begin in the earliest grades, handicapped by the weak knowledge of mathematics of their own elementary teachers. NCTQ looks at the quality of preparation provided by a representative sampling of institutions in nearly every state. We also provide a test developed by leading mathematicians which assesses for the knowledge that elementary teachers should acquire during their preparation. Imagine the implications of an elementary teaching force being able to pass this test."

For an *Inside Higher Ed* article on this report see Heggen (2008).

Nelson. C.E. 1996. "Student Diversity Requires Different Approaches to College Teaching, Even in Math and Science." *American Behavioral Scientist* **40**:165-175; online at < http://mypage.iu.edu/~nelson1/96_StudentDiversity.pdf >. The entire issue is on "multiculturalism and diversity in higher education."

*Nelson, C.E. 2000a. "Must Faculty Teach in Ways That Make Them Easily Dispensable?" *National Teaching & Learning Forum* **9**(6); online at < http://mypage.iu.edu/~nelson1/00_2_MustFacTch.pdf > (1.5 MB).

*Nelson, C.E. 2000b. *Bibliography: How To Find Out More About College Teaching And Its Scholarship: A Not Too Brief, Very Selective Hyperlinked List. (College Pedagogy IS A Major Area Of Scholarship!)* < http://php.indiana.edu/~nelson1/TCHNGBKS.html >.

#LPE *Nelson, C.E. 2006. "Celebration and Reflection," *MountainRise* **3**(1), online at < http://mountainrise.wcu.edu/archive/vol3no1/html/nelson.html >. Nelson concludes:

> "For a variety of reasons, it is becoming much clearer that major real world problems are collectively worse than most faculty have previously realized. These include global climatic change, social inequity, national and international disease situations and geopolitical problems. Public discourse in a nation's capital on these issues can be seen as a collective final exam for the institutions of higher education in that country. Most of the major players in the national government, at least in the US, have an undergraduate degree and many have a graduate or professional degree. *But policies and public discourse rarely seem to adequately grasp the complexities and tradeoffs*. [Our *italics*.] Perhaps I am being too optimistic in suggesting that more than a few faculty see SOTL . . . .[Scholarship of Teaching and Learning]. . . . as a way of focusing higher education on finding more effective ways to foster fundamental outcomes like critical thinking, engagement with the real world and sophisticated ethical judgment. I, for one, certainly hope that the effects of SOTL will extend this far."

*Nelson, C.E. & J.M. Robinson. 2006. "The Scholarship of Teaching and Learning and Change in Higher Education," Ch.7 (pp. 78-90) in Hunt *et al*. (2006).

Newberg, H. 2001. "Changing Roles for Women in Research Universities," invited talk at the April 2001 meeting of the APS; online at < http://www.rpi.edu/~newbeh/rrwp.htm >.

#SV Newcombe, N.S. 2006. "Taking Science Seriously: Straight Thinking About Spatial Sex Differences," in Ceci & Williams (2006).

#FSC #CS *Newton, R. 1997. *The Truth of Science: Physical Theories and Reality*. Harvard University Press, publisher's information at
< http://www.hup.harvard.edu/catalog/NEWTRU.html > :

> "To claims that science is a social construction, Newton answers with the working scientist's credo: 'A body of assertions is true if it forms a coherent whole and works both in the external world and in our minds.' The truth of science, for Newton, is nothing more or less than a relentless questioning of authority combined with a relentless striving for objectivity in the full awareness that the process never ends. With its lucid exposition of the ideals, methods, and goals of science, his book performs a great feat in service of this truth.

*Newton, R. 1997. *What Makes Nature Tick?* Harvard University Press, publisher's information at < http://www.hup.harvard.edu/catalog/NEWWHA.html >.

#CS *Newton, R. 1998. "Guest Comment: The science wars." *Am. J. Phys.* **66**(4): 282-283; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=66&Issue=4 >
Newton wrote:

> "Most physicists are aware of what is generally referred to as the *science wars*, but their attitude tends to be dismissive—why should we waste our time arguing against the arrant nonsense of the 'social constructivists'? I believe this stance to be mistaken, not because I expect these critics to be capable of doing irreparable damage to science directly, but because those they teach will become future teachers of our young, legislators who write laws and dispense funds touching on science, voters who will elect them, and jury members who may have to make life or death decisions by judging scientific evidence. We should worry when those who look at species as cultural constructs are not concerned about their extinction. We should worry when those who think science is but 'politics by other means' refuse to give credence to scientists who conclude that high-voltage powerlines are harmless."

*NISE. 2001. Homepage at < http://www.wcer.wisc.edu/archive/nise/ > :

> "The National Institute for Science Education was created and funded by the National Science Foundation for five years from 1996-2001. Additional support was provided by the Helen Bader Foundation, the ExxonMobil Foundation, the Joyce Foundation, the Spencer Foundation, and the University of Wisconsin-Madison Graduate School. The NISE Web site contains information on all NISE projects over the five year grant period and includes copies of publications, contacts, and links to related Web sites. While numerous programs including the Systemic Reform project, the Secondary Teacher Education Project, The Why Files, and several College Level One-related projects . . . [< http://tinyurl.com/4m38wr >]. . . are ongoing, the information on this site will not be updated after June 30, 2001."

*NISE. 2003. National Institute for Science Education. Bibliography of NISE Publications online at < http://tinyurl.com/6e4wfp >.

Norby, R.F. 1997. "Evaluating progress in gender equity in careers for women in science and technology," *Electronic J. Sci. Educ.* 1(3); online at < http://unr.edu/homepage/jcannon/ejse/norby.html >.

Norby, R.F. 2000. "Equitable teaching of physics to women students: Thoughts for a new decade," *Phys. Teach.* **38**(8): 494-495; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=PHTEAH&Volume=38&Issue=8 >.

Nostrand, T. & and H. Lee. 2007. "Science Really Can be Like This: Two Reviews of the Women's Adventures in Science Series," *AWIS Magazine,* Winter, online at < http://www.awis.org/pubs/documents/Awis_Winter2007_000.pdf > (3.2 MB).

#EC NSB. 2004. National Science Board, *Science and Engineering Indicators 2004* (Vol. 1, NSB 04-1; Vol. 2, NSB 04-1A), online at < http://www.nsf.gov/statistics/seind04/ >.

In the overview < http://www.nsf.gov/statistics/seind04/c0/c0s1.htm > it is stated:

"In 2000, women earned between 40 and 60 percent of bachelor's degrees in mathematics; physical, earth, ocean, and atmospheric sciences; and agricultural and biosciences. They also earned more than 75 percent of psychology degrees. Their share of engineering degrees increased from 2 percent in the mid-1970s to 20 percent, but their computer science share remained below one-third."

In Chapter 2 "Higher Education in Science and Engineering – Conclusion" at < http://www.nsf.gov/statistics/seind04/c2/c2c.htm > the NSB states:

"Governments around the world are expanding access to higher education *to develop an educated workforce that will contribute to economic growth and competitiveness*.[Our *italics*.] Many countries have successfully increased the rate at which their college-age citizens earn S&E degrees. The United States has been less successful in this regard, particularly in the combined natural sciences, mathematics, computer sciences, and engineering fields that are considered critical to technological innovation. At the same time, mature industrial countries facing adverse demographic shifts are considering strategies to import highly trained foreign labor, especially from developing nations."

#EC NSB. 2006a. National Science Board, *Science and Engineering Indicators 2006*, online at < http://nsf.gov/statistics/seind06 > and < http://nsf.gov/statistics/seind06/pdfstart.htm >.

In Chapter 2 "Higher Education in Science and Engineering" at < http://www.nsf.gov/statistics/seind06/c2/c2s4.htm > the NSB states:

"In 2003, women earned 39% of S&E doctoral degrees awarded in the United States. The percentage of S&E doctoral degrees earned by women in other countries and areas of the world varied widely. In Western Europe, the percentages earned by women varied from 27% in Germany to 45% in Italy. In Asia, women earned roughly one-fifth of all S&E doctoral degrees."

In Chapter 4, "Research and Development: Funds and Technology Linkages" at < http://www.nsf.gov/statistics/seind06/c4/c4s6.htm > it is stated:

"Increasingly, *the international competitiveness of a modern economy is defined by its ability to generate, absorb, and commercialize knowledge*. [Our *italics*.] Although it is no panacea, scientific and technological knowledge has proven valuable in addressing the challenges countries face in a variety of areas such as sustainable development, ... [our insert - in contrast to "sustainable growth," "sustainable development" is not *necessarily* an oxymoron – see Bartlett (1998) and Daly (1996)]. . . economic growth, health care, and agricultural production. Nations benefit from R&D performed abroad, but domestic R&D performance is an important indicator of a nation's innovative capacity and its prospects for future growth, productivity, and S&T competitiveness. This section compares international R&D spending patterns. Topics include absolute expenditure trends, measures of R&D intensity, the structure and focus of R&D performance and funding across sectors, and government research-related priorities and policies."

#EC NSB. 2006b. National Science Board, *America's Pressing Challenge – Building A Stronger Foundation: A Companion to Science and Engineering Indicators 2006*; online at < http://www.nsf.gov/statistics/nsb0602/nsb0602.pdf >. On page 6 the NSB wrote (our *italics*) :

"*America's competitive edge in this 'flat world,' its strength and versatility, all depend on an educational system capable of producing young people and productive citizens who are well prepared in science and mathematics*. We know – and this report demonstrates – that there is a need to make drastic changes within the Nation's science and mathematics classrooms. If not, our Nation risks raising generations of students and citizens who do not know how to think critically and make informed decisions based on technical and scientific information. Nor will they have a firm grasp of academic language necessary to advance into STEM careers and produce the innovation and discovery necessary to maintain our Nation's prosperity for the future."

#EC NSB. 2008. National Science Board. *Science and Engineering Indicators 2008*, online as Volume 1 (9.5 MB pdf) and Volume 2: Appendix Tables (2.7 MB) at < http://www.nsf.gov/statistics/seind08/pdfstart.htm >.

In Chapter 2 "Higher Education in Science and Engineering" < http://www.nsf.gov/statistics/seind08/pdf/c02.pdf > (296 kB) it is stated:

"Among U.S. citizens, the proportion of S&E doctoral degrees earned by women has risen considerably in the past two decades, reaching a record high of 46% in 2005 (appendix table 2-31). During this period, women made gains in all major fields. However, as figure 2-21 shows, considerable differences by field continue. Women earn half or more of doctorates in non-S&E fields, in social/behavioral sciences, and in life sciences, but they earn considerably less than half of doctorates in physical sciences (29%), math/computer sciences (24%), and engineering (20%) (appendix table 2-31). Although the percentages of degrees earned by women in these fields is low, they are substantially higher than was the case in 1985 (16%, 17%, and 9%, respectively)."

In the Overview at < http://www.nsf.gov/statistics/seind08/c0/c0s4.htm > it is stated:

"The progressive shift toward more knowledge-intensive economies around the world is dependent upon the availability and continued inflow of individuals with postsecondary training to the workforce. The expansion of higher education systems in many countries that started in the 1970s and continues today has enabled this shift to occur. Such broadening of higher education availability and access in many cases entailed greater relative emphasis than in the United States on education and training in engineering, natural sciences, and mathematics. Demographic structures, stable or shrinking populations, expanding opportunities in other fields, and *declining interest in mathematics and science among the young are viewed by governments of many mature industrial countries as a potential threat to the sustained competitiveness of their economies*. The topic has assumed increasing urgency in meetings of ministers of OECD member countries. [Our *italics*.]

NSF. 2004. National Science Foundation, "Gender Differences in the Careers of Academic Scientists and Engineers," NSF 04-323, Project Officer, Alan I. Rapoporton, online at < http://www.nsf.gov/statistics/nsf04323/ > and as a pdf at < http://www.nsf.gov/statistics/nsf04323/pdf/nsf04323.pdf > (1.5 MB).

NSF. 2005a. National Science Foundation. Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (CAWMSET); online at < http://www.nsf.gov/od/cawmset/ > :

"The term of the Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (CAWMSET) has expired. There is no longer a CAWMSET office or staff. The Commission's report, *Land of Plenty: Diversity as Americas Competitive Edge in Science, Engineering, and Technolog* is available through the NSF on-line document system. Click on < http://www.nsf.gov/pubs/2000/cawmset0409/cawmset_0409.pdf > (1.4 MB) to access the report. (CAWMSET) was established by Congress on October 14, 1998, through legislation developed and sponsored by Congresswomen Constance A. Morella (R-MD). The mandate of the Commission is to research and recommend ways to improve the recruitment, retention, and representation of women, underrepresented minorities (namely, African Americans, Hispanic Americans, and American Indians), and persons with disabilities in science, engineering, and technology (SET) education and employment. Commission exploration of the status of these underrepresented populations in SET has reaffirmed the nation's absolute economic and social imperative to ensure that all U.S. citizens enjoy full participation at all levels of SET education and the SET workforce."

NSF. 2005b. Research on Gender in Science and Engineering FY 2005 (GSE), Program Solicitation NSF 04-608, online at
< http://www.nsf.gov/pubs/2004/nsf04608/nsf04608.htm#toc >.

NSF. 2007a. "National Science Foundation Releases Statistics on Women, Minorities and Persons with Disabilities," Press Release, online at
< http://www.nsf.gov/news/news_summ.jsp?cntn_id=108454 >. The report is available at
< http://www.nsf.gov/statistics/wmpd/ >.

NSF. 2007b. "ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers," program solicitation, online at
< http://www.nsf.gov/pubs/2007/nsf07582/nsf07582.htm >. See also "NSF Advance Project" [University of Michigan (2002)] and "The NSF ADVANCE Program: Promoting Women in Academic Science and Engineering" [Springs & Braff (2007)].

NWSA. 2007. National Women's Studies Association, "Mapping Women's and Gender Studies Data Collection" < http://www.nwsa.org/projects/database/index.php >. See especially "A National Census of Women's and Gender Studies Programs in U.S. Institutions of Higher Education," online at
< http://www.nwsa.org/projects/database/downloads/NWSA_Data_Report_08.pdf > (188 kB).

NWSA. 2008a. National Women's Studies Association, online at
< http://www.nwsa.org/index.php > :

> Mission: The National Women's Studies Association leads the field of women's studies in educational and social transformation. Established in 1977, NWSA has more than 2,000 individual and institutional members worldwide. The Association provides critical support for members pursuing bold goals on their campuses and in their communities by challenging existing power structures and working to create a world built upon principles of social justice.

#EC O'Brien, M. 2008. *Human Resource Executive Online, 27* May, "Analyzing Female Brain Drain"; online at
< http://www.hreonline.com/HRE/story.jsp?storyId=96768436 >. The abstract reads [our inserts at ". . . .[insert]. . . ."]

> "Dueling reports on women in the sciences offer contrasting opinions on reasons for the scarcity of women in such industries. One report. . . [Hewlett et al. (2008)]. . . . urges HR leaders to address issues of sexual harassment, isolation and the scarcity of mentors, while two others. . .[Rosenbloom *et al*. (2008) & Benbow & Lubinski (2008)]. . . . conclude that women simply prefer jobs where they can interact with people, such as medicine."

Ogilvie, M. B. & J.D. Harvey, eds. 2007. *The Biographical Dictionary Of Women In Science: Pioneering Lives from Ancient Times to the Mid-20th Century*. Taylor & Francis, Amazon.com information at < http://tinyurl.com/3x2bsj >. From *Library Journal*:

> "Well known for her *Women in Science: Antiquity Through the Nineteenth Century*, Ogilvie has joined with Harvey *(Almost a Man of Genius*) to publish a two-volume bio/bibliographical resource covering approximately 2500 women scientists from all over the world. Recent biographical publications devoted to women scientists, such as Notable Women in the Physical Sciences: A Biographical Dictionary (Greenwood, 1997) and American Women in Science, 1950 to the Present (LJ 2/15/99), are limited by either discipline, time period, or nationality. Ogilvie and Harvey include scientists from across all fields and nationalities, although they admit that the dictionary is still slanted toward the United States and Great Britain owing to language barriers and the amount of information available. The editors use broader criteria for earlier time periods but apply more stringent standards for later centuries, when science became more professionalized. The entries were written by a small group of contributors comprising scientists and historians. Arranged alphabetically, each entry has a short summary of personal information, education, and professional experience, a brief biographical narrative, and a bibliography of selected primary and secondary sources. The entries range from very brief to a few pages for the better-known subjects. Indexes include lists of scientists by occupation, time period, and country as well as a subject index. Ogilvie and Harvey have compiled a very comprehensive biographical resource that is highly recommended for academic and public libraries."
>
> D. Teresa Berry, Univ. of Tennessee Libs., Knoxville

Olsen, K.L. 2007. Testimony Before the Committee on Science and Technology Subcommittee on Research and Science Education, online at < http://www.nsf.gov/about/congress/110/klo_academicscieng_101707.jsp > :

> "Chairman Baird, Ranking Member Ehlers, and distinguished members of the Subcommittee, thank you for the invitation to testify on the National Science Foundation's (NSF) role in advancing women's participation in academic science and engineering. The NSF considers this topic central for the continued vitality of the nation's scientific enterprise. The focus on women in science and engineering constitutes a longstanding and important component of NSF's strategic investment portfolio. A high priority within that portfolio is broadening participation of groups underrepresented in science and engineering, namely, women, minorities, and persons with disabilities. Thus, some of the many NSF programs aimed at broadening participation in S&E focus specifically on women. These programs address the Learning goal in the NSF FY 2006-2011 Strategic Plan, *Investing in America's Future*: to cultivate a world-class, broadly inclusive science and engineering workforce, and to expand the scientific literacy of all citizens."
>
> Kathie L. Olsen, is the Deputy Director of the National Science Foundation

Olson, S. 2006. "Nurturing Mathematical Talent: Views from the Top Finishers in the William Lowell Putnam Mathematical Competition," online at < http://www.msri.org/activities/pastprojects/jir/Summary_report.pdf >. Olson wrote:

> "The 2004 Putnam exam had an unusual number of top female finishers -- four of the top fifteen participants were women. This marks by far the most women who have finished in the top levels of the exam and comes after several years of growing female participation in the Putnam. Several of the students I interviewed expressed the belief that increasing numbers of women would enter and perform well in the competition because of the examples being set by current top finishers. "It [competition] somehow seems like a male thing to do," said Andrei Negut of Princeton. "I think it's just a cultural thing that girls don't participate more."

[#EC] OSTP. 2000. Office of Science Technology and Policy, *Ensuring a Strong U.S. Scientific, Technical, and Engineering Workforce in the 21st Century*, online as a 121 kB pdf at < http://clinton4.nara.gov/WH/EOP/OSTP/html/00411_3.html > (our *italics*):

"Our nation's *international competitiveness* and national well-being have long depended on a highly skilled ST&E workforce. Recent studies have shown that science and technology have generated about half the productivity growth the United States has enjoyed over the past 50 years; created millions of high-skill, high-wage jobs; and improved the quality of life in America. Those productivity increases must continue in the 21st century if our high standard of living is to be maintained or improved. . . . . .

In 1996, women earned almost half (47 percent) of the S&E bachelor's degrees but only 38 percent of the master's degrees and *32 percent of the doctorates*. The latter statistic is particularly significant, because it is the Ph.D. degree that enables women to join university faculties and serve as role models for female students who will become part of the future ST&E workforce. While participation of women has increased significantly over the past two decades, further improvement is needed. The percentage of women in science, technology and engineering varies greatly from field to field. Women earned 38 percent of all science and engineering master's degrees awarded in 1996. This included 53 percent of those in biological science, but only 17 percent of those in engineering. In 1996, women earned 51 percent of the doctorates in the social and behavioral sciences and 42 percent in biology, but only 12 percent in engineering, 15 percent in computer sciences, and 21 percent in mathematics. *Thus women's relative percentages are low in some fields that have rapidly increasing demands for highly skilled workers and are important for economic growth*."

[#SSIGD] Otwell, S. 2005. "CSWP Responds to Harvard University President's Comments," CSWP Gazette, Spring, online at < http://www.aps.org/programs/women/reports/gazette/upload/spring05.pdf > (748 kB).

[#SV] Pallrand, G.J. & F. Seeber, 1984. "Spatial Ability and Achievement in Introductory Physics." *Journal of Research in College Teaching* **21**(5): 507-516; abstract online at < http://tinyurl.com/4qwlb2 > :

"This research was undertaken to clarify the nature of the relationship between visual-spatial abilities and achievement in science courses. A related purpose was to determine what influence visual-spatial abilities have on the high attribution rate characteristic of many introductory college-level science courses. Three sections of introductory college level physics (S = 136) and one nonscience liberal arts section (S = 52) received pre- and postmeasures of visual-spatial ability in the areas of perception, orientation, and visualization. Increases in visual-spatial abilities were greatest with an experimental section that received a spatial intervention. These gains were related to test items that utilized graphical form and to laboratory work. Substantial gains in visual-spatial ability were also registered by a placebo and by control sections. These increases suggest that taking introductory physics improves visual-spatial abilities. Although students who withdrew from the course demonstrated mathematics skills comparable to those of students who completed the course, their scores on perception tests were appreciably lower. Visual-spatial scores of the liberal arts group were lower than those of the physics sections, suggesting that visual-spatial ability influences course selection."

Parker, L.H., L. Rennie, B. Fraser, B., eds. 1995. *Gender, Science and Mathematics: Shortening the Shadow*. Springer, publisher's information at < http://www.springer.com/education/book/978-0-7923-3582-5 >. A Google "book preview" is online at < http://tinyurl.com/48exdp >.

Parker, L.H., L.J., Rennie, & J. Harding. 1995. "Gender Equity," in B.J. Fraser & H.J. Walberg, eds. *Improving Science Education* (pp. 186-210). National Society for the Study of Education. Amazon.com information at < http://tinyurl.com/6299gm >. Note the "Search Inside" feature. We thank Leslie Dickie for this reference. The summary by editors Fraser & Walberg is:

> "In 'Gender Equity' (chapter 9), Lesley Parker, Leonie Rennie, and Jan Harding describe the differences between boys and girls in science attitudes, learning, and participation. In general, boys do better in all three respects, partly because of instructional inequality. For example, an analysis of 81 studies of teacher - pupil interaction showed that girls receive less of the teacher's attention in classes under a wide range of conditions. Of some 600 programs for extending better opportunities to girls, many rely on segregated classes, special curricula, teacher education, role modeling, and extra-curricular and co-curricular activities. The authors discuss the conditions for success of such programs, and their recommendations for improving gender equity are that:
>
> a. the school science curriculum should be compulsory, broad-based, and include consideration of gender stereotypes and career education aimed at breaking down these stereotypes;
>
> b. resources in science education should avoid gender bias in language and choice of examples, and include case studies of successful women scientists;
>
> c. science teachers, administrators, teacher educators, and teacher trainees should undertake educational programs that make them aware of the problems of gender stereotyping and give them the skills to counter it;
>
> d. gender bias should be avoided in the content, context, and mode of assessment in science."

Parker, L.H. 2003. "The Evolving Gender-ICT Agenda In Education," [ICT = Information and Communications Technology], GASAT #11 (2003), online at < http://www.gasat-international.org/conferences/G11Mauritius/proceedings/proceedings.pdf > (456 kB).

> Table 2 shows a "Summary of Computer or ICT-Related Papers at GASAT Conferences, 1981-2001. Parker states "some conference proceedings are missing from my list, because I did not have access to the publications. I will return to this point later in the paper." Her "return" is at GASAT International (2008).

*Pavelich, M., B. Jenkins. J. Birk, R. Bauer, & S. Krause. 2004. "Development of a Chemistry Concept Inventory for Use in Chemistry, Materials and other Engineering Courses," *Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition* online at < http://www.asee.org/acPapers/2004-1907_Final.pdf > (124 kB).

Pfabe, M. & N. Easwar. 1999. "Guest Comment: The Picker Engineering Program at Smith College: Building a new educational paradigm and bridging the gender gap." *Am. J. Phys.* 67(10): 849, online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=67&Issue=10 >. The authors wrote:

> "The presence of the engineering program in a women's college adds another valuable dimension. The engineering profession is creative and challenging and women have much to contribute to a wide range of engineering disciplines. *While women account for 50% of college students, they constitute less than 20% in engineering. Moreover, women hold only about 9% of advanced degrees in engineering. Whereas in the fields of medicine, business, and law there is gender parity, even today five out of six engineering students are male. The attrition rate among women studying engineering is still high, most likely due to a lack of a strong faculty and peer support*. This will not be the case in a women's college where all engineering students, being women, will enjoy strong peer support. Further, our faculty, being familiar with the mission of the college, can create a supportive atmosphere of rigorous scientific learning steeped in the liberal arts for women. *Any step toward opening more paths for women in scientific and engineering fields is a step in the right direction*." (Our *italics*.)

An AAC&U article of August 2007 on the Picker Engineering Program titled "Engineering a Liberal Education" is online at < http://www.aacu.org/aacu_news/AACUNews07/august07/feature.cfm >.

Phillips, A.L. 2008. Interview with Wendy M. Williams regarding Ceci & Williams (2006). *American Scientist Online* < http://www.americanscientist.org/template/InterviewTypeDetail/assetid/56279 > :

> "Why aren't more women in science?" This question, which serves as the title of a new book edited by Stephen J. Ceci and Wendy M. Williams, has inspired intense debate in the media and among scientists and the general public. Responses range from the polemical to the well-considered; Williams and Ceci hope to refocus the debate with evidence-based ideas. In their new book, subtitled *Top Researchers Debate the Evidence*, they present essays from contributors including Simon Baron-Cohen, Janet Shibley Hyde, Doreen Kimura and Elizabeth S. Spelke, among others. The result is a thought-provoking, challenging collection that covers topics ranging from neural substrates for sex differences in cognition to cultural bias against women and other sociocultural forces. The book won a bronze medal in the 2007 IPPY (Independent Publisher) Book Awards."

See also "Women in Academe, and the Men Who Derail Them" [Williams (2002)].

#CE #CS *Phillips, D. C. 1995. "The good, the bad, and the ugly: The many faces of constructivism," *Educational Researcher* **24**(7): 5-12; online at < http://edr.sagepub.com/cgi/reprint/24/7/5 >. Reprinted in Curren (2006). Also reprinted with some changes and additions as Chapter 1 of Phillips (2000). See also Taber (2006). Phillips identifies the *ugly* as the quasi-religious or ideological aspects of constructivism and then writes:

> "The *good*. . . . is the emphasis that various constructivist sects place on the necessity for active participation by the learner, together with the recognition (by most of them) of the social nature of learning; it seems clear that, with respect to their stance on education, most types of constructivism are modern forms of progressivism. Constructivism also deserves praise for bringing epistemological issues to the fore in the discussion of learning and the curriculum. . . . The *bad* . . . . .are constructivist epistemologies that tend (despite their occasional protestations to the contrary) toward relativism and make the justification of our knowledge-claims pretty much entirely a matter of sociopolitical processes or consensus, or that jettison any justification or warrant at all (as arguably the case with radical social constructivism)."

#CE #CS *Phillips, D.C. 2000a. *Expanded social scientist's bestiary: a guide to fabled threats to, and defenses of, naturalistic social science*. Rowman & Littlefield; publisher's information at < http://tinyurl.com/ycmlvy >.

#CE #CS *Phillips, D.C., ed. 2000b. *Constructivism in Education: Opinions and Second Opinions on Controversial Issues*. Ninty-ninth Yearbook of the National Society for the Study of Education, Part 1. University of Chicago Press, publisher's information at < http://www.press.uchicago.edu/cgi-bin/hfs.cgi/00/14066.ctl > :

Constructivism in Education is a lively discussion of the varieties of constructivist thought which have been applied to the teaching of school subjects, especially science and mathematics. Contributors include philosophers of education and specialists in science, mathematics, and childhood education.

Phillips, L. 1998. *The Girls Report: What We Know & Need to Know About Growing Up Female,* online at < http://www.ncrw.org/research/girlsrpt.htm >. National Council for Research on Women [NCRW (2008)].

Phipps, A. 2008. *Women in Science, Engineering and Technology: three decades of UK initiatives*. Trentham Books, publisher's information at < http://tinyurl.com/6qw4sw >.

Physics World. 2002. Special Issue on "Women in Physics," March 2002, online at < http://physicsweb.org/toc/world >. See especially the editorial "Physics needs women" at < http://physicsworld.com/cws/article/print/5185 >.

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a. Turning women into leaders < http://physicsworld.com/cws/article/print/5186 >

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d. Learning lessons from the classroom < http://physicsworld.com/cws/article/print/5194 >

e. PhDs are worth more for women < http://physicsworld.com/cws/article/print/14 >

f. New hope for physics education < http://physicsworld.com/cws/article/print/914 >.

#SSG Pipher, M. 2005. *Reviving Ophelia: Saving the selves of adolescent girls*. Riverhead Trade, Amazon..com information at < http://tinyurl.com/5orxuq > :

"At adolescence, says Mary Pipher, 'girls become 'female impersonators' who fit their whole selves into small, crowded spaces.' Many lose spark, interest, and even IQ points as a 'girl-poisoning' society forces a choice between being shunned for staying true to oneself and struggling to stay within a narrow definition of female. Pipher's alarming tales of a generation swamped by pain may be partly informed by her role as a therapist who sees troubled children and teens, but her sketch of a tougher, more menacing world for girls often hits the mark. She offers some prescriptions for changing society and helping girls resist."

#EB #SDMA Pinker, S. 2003. *Blank Slate: The Modern Denial of Human Nature*. Penguin Group. Barnes & Noble information at
< http://search.barnesandnoble.com/Blank-Slate/Steven-Pinker/e/9780142003343/?itm=2 >.
Note the "See Inside" feature.

From *Publishers Weekly*:

. . . . . .Drawing on decades of research in the "sciences of human nature," Pinker, a chaired professor of psychology at MIT, attacks the notion that an infant's mind is a blank slate, arguing instead that human beings have an inherited universal structure shaped by the demands made upon the species for survival, albeit with plenty of room for cultural and individual variation. . . . . He goes on to tour what science currently claims to know about human nature, including its cognitive, intuitive and emotional faculties, and *shows what light this research can shed on such thorny topics as gender inequality*, child-rearing and modern art. [Our *italics*.]

Pinker's advertisement at < http://pinker.wjh.harvard.edu/books/tbs/index.html > states:

"In *The Blank Slate,* Steven Pinker, bestselling author of *The Language Instinct* and *How the Mind Works,* explores the idea of human nature and its moral, emotional, and political colorings. He shows how many intellectuals have denied the existence of human nature by embracing three linked dogmas: The Blank Slate (the mind has no innate traits), The Noble Savage (people are born good and corrupted by society), and The Ghost in the Machine (each of us has a soul that makes choices free from biology). Each dogma carries a moral burden, so their defenders have engaged in the desperate tactics to discredit the scientists who are now challenging them.

Pinker tries to inject calm and rationality into these debates by showing that equality, progress, responsibility, and purpose have nothing to fear from discoveries about rich human nature. He disarms even the most menacing threats with clear thinking, common sense, and pertinent facts from science and history. Despite its popularity among intellectuals during much of the twentieth century, he argues, the doctrine of the Blank Slate may have done more harm than good. It denies our common humanity and our individual preferences, replaces hardheaded analyses of social problems with feel-good slogans, and distorts our understanding of government, violence, parenting, and the arts."

An interview with Pinker regarding this book is online as "A Biological Understanding Of Human Nature: A Talk With Steven Pinker" at
< http://www.edge.org/3rd_culture/pinker_blank/pinker_blank_print.html >.

According to Hemel's (2005b) interview with Lawrence Summers, Summers' speculation on innate gender differences in math/science abilities came from scholars cited in Pinker's (2003) *The Blank Slate: The Modern Denial of Human Nature*. According to reference 20 in the AWM's (2005) petition background, among the scholars cited by Pinker are Hedges and Nowell (1995) and Lubinski and Benbow (1992).

#EB #SSIGD #SDMA Pinker, S. & E. Spelke. 2005. "The Science Of Gender And Science - Pinker vs. Spelke - A Debate on the research on mind, brain, and behavior that may be relevant to gender disparities in the sciences, including the studies of bias, discrimination and innate and acquired difference between the sexes," online at < http://www.edge.org/3rd_culture/debate05/debate05_index.html >. See also Pinker (2003) and a video of the debate at < http://www.edge.org/3rd_culture/bios/pinker.html >. An excerpt from the Introduction to the debate is as follows:

> "On April 22, 2005, Harvard University's Mind/Brain/Behavior Initiative (MBB) held a defining debate on the public discussion that began on January 16th with the public comments by Lawrence Summers, president of Harvard, on sex differences between men and women and how they may relate to the careers of women in science. The debate at MBB, 'The Gender of Gender and Science' was 'on the research on mind, brain, and behavior that may be relevant to gender disparities in the sciences, including the studies of bias, discrimination and innate and acquired difference between the sexes.' It's interesting to note that since the controversy surrounding Summers' remarks began, there has been an astonishing absence of discussion of the relevant science...you won't find it in the hundreds and hundreds of articles in major newspapers; nor will find it in the Harvard faculty meetings where the president of the leading University in America was indicted for presenting controversial ideas. . . . . But unlike just about anything else said about Summers' remarks, the debate, 'The Science of Gender and Science,' between Harvard psychology professors Steven Pinker and Elizabeth Spelke, focused on the relevant scientific literature. It was both interesting on facts but differing in interpretation (sic)."

An interesting excerpt of Pinker's side of the debate is as follows:

> "For those of you who just arrived from Mars, there has been a certain amount of discussion here at Harvard on a particular datum, namely the under-representation of women among tenure-track faculty in elite universities in physical science, math, and engineering. . . . . Here are some recent numbers: Percentages of female faculty in tenure track positions in elite universities: Math: 8.3%, Chemisty: 12.1%, Chemical Engineering: 10.5%, Physics: 6.6%, Mechanical Engineering: 6.7%, Electrical Engineering: 6.5%, Civil Engineering: 9.8%, Computer Science: 10.6%, Astronomy: 12.6%. . . . [Our insert – no source for these numbers is given.]
>
> As with many issues in psychology, there are three broad ways to explain this phenomenon. One can imagine an extreme 'nature' position: that males but not females have the talents and temperaments necessary for science. Needless to say, only a madman could take that view. The extreme nature position has no serious proponents.
>
> There is an extreme 'nurture' position: that males and females are biologically indistinguishable, and all relevant sex differences are products of socialization and bias.
>
> Then there are various intermediate positions: that the difference is explainable by some combination of biological differences in average temperaments and talents interacting with socialization and bias.
>
> Liz [Spelke] has embraced the extreme nurture position. . . . . .Liz has said that there is 'not a shred of evidence' for the biological factor, that 'the evidence against there being an advantage for males in intrinsic aptitude is so overwhelming that it is hard for me to see how one can make a case at this point on the other side,' and that 'it seems to me as conclusive as any finding I know of in science.'

These are extreme statements — especially in light of the fact that an enormous amount of research, summarized in these and many other literature reviews, in fact points to a very different conclusion. I'll quote from one of them, a book called *Sex Differences in Cognitive Ability*. . . .[Diane Halpern (2000)].. . . . . She is a respected psychologist, recently elected as president of the American Psychological Association, and someone with no theoretical axe to grind. She does not subscribe to any particular theory, and has been a critic, for example, of evolutionary psychology. And here is what she wrote in the preface to her book:

> 'At the time I started writing this book it seemed clear to me that any between sex differences in thinking abilities were due to socialization practices, artifacts, and mistakes in the research. After reviewing a pile of journal articles that stood several feet high, and numerous books and book chapters that dwarfed the stack of journal articles, I changed my mind. The literature on sex differences in cognitive abilities is filled with inconsistent findings, contradictory theories, and emotional claims that are unsupported by the research. Yet despite all the noise in the data, clear and consistent messages could be heard. There are real and in some cases sizable sex differences with respect to some cognitive abilities. Socialization practices are undoubtedly important, but there is also good evidence that biological sex differences play a role in establishing and maintaining cognitive sex differences, a conclusion I wasn't prepared to make when I began reviewing the relevant literature.' "

Pinker, Susan. 2008. *The Sexual Paradox: Men, Women and the Real Gender Gap*. Scribner. Amazon.com information at
< http://www.amazon.com/Sexual-Paradox-Women-Real-Gender/dp/0743284704 >:

FROM PUBLISHERS WEEKLY: "Why, according to 2003 figures, do women constitute 49% of law school graduates but only 27% of practicing lawyers? Defying taboos, Pinker . . .[our insert – see < http://www.susanpinker.com/ >]. . . . , a psychologist and columnist for the *Globe & Mail*, presents a compelling case for a biological explanation of why men and women make different career choices. Drawing on comprehensive scientific and social evidence and case studies, she proposes that hormones are a determining factor. The hormones predominant in men lead to action, focus and, often, to competitive and rigidly hierarchical professions such as law. Women's hormones lead them to focus on empathy and social interaction, and careers as teachers or social workers. Thus, despite their early advantages—girls have better language skills and discipline, while boys are more prone to dyslexia, autism and Asperger syndrome and other difficulties—women tend not to seek out the highest status or the most lucrative careers: They're reluctant to take jobs whose demands won't allow them the choice to focus on other aspects of their lives. Pinker says she isn't calling for a return to the 1950s housewife model. She emphasizes individual differences among men and women, but hopes that wider recognition of gender differences can lead to greater workplace flexibility and room for women's professional advancement on their own terms. She may draw a great deal of fire for this book, but her strong evidence could also open a better-informed discussion of the issues."

Susan Pinker's orientation appears to be similar to that her brother Steven – see e.g., *Blank Slate: The Modern Denial of Human Nature* [Pinker (2003)].

#IE Pollock, S.J., N.D. Finkelstein, & L. Kost. 2007. "Reducing the Gender Gap in the Physics Classroom: How sufficient is interactive engagement?," *Phys Rev: ST Phys Ed. Res.* **3**, 010107 (2007); online at < http://prst-per.aps.org/abstract/PRSTPER/v3/i1/e010107 >. The abstract is (our *italics*):

> Previous research ["Reducing the Gender Gap in the Physics Classroom" (Lorenzo *et al*., 2006)] demonstrated that the difference in performance between male and female students can be reduced and even eliminated, in consistent fashion, by using interactive engagement techniques in the introductory physics classroom. The present paper describes similar studies in a different, large research university and *finds that the use of interactive engagement techniques does not necessarily reduce the gender gap*. Furthermore, in the environments studied, there is a gap in learning gains between male and female students ($p < 0.01$) whether partially or fully interactive classroom techniques are used. . . . [our insert - an informative statistic would have been the "effect size" and its comparison with the "interactive engagement" vs "traditional" effect size as was discussed in "Relationship of Individual Student Normalized Learning Gains in Mechanics with Gender, High-School Physics, and Pretest Scores on Mathematics and Spatial Visualization" [Hake (2002b)]. . . . Our findings suggest that engaging students in interactive educational environments is not sufficient to reduce the gender gap, and we find instances where despite significant learning gains by all students, the gender gap is increased. There is indication that there are both student and instructor effects that impact the gender gap, which are the subjects of ongoing studies.

Potter, W.H., C.J. De Leone, C.M. Ishikawa, J.A. Blickenstaff, & P.L Hession. 2001. "Gender Disparity Patterns: A Universal Measure of Reform Course Success?" *AAPT Announcer* **31**(2): 117.

Pozner, J. 1997. *Uncovering the Right on Campus*. Center for Campus Organizing. For an excerpt critical of the "Independent Women's Forum" see "Female Anti-Feminism for Fame and Profit," online at < http://organizenow.net/cco/right/antifem.html >.

Preston, A.E. 2004. "Plugging the Leaks in the Scientific Workforce: Much more needs to be done to reverse the high rate of attrition of both men and women early in their scientific careers," *Issues in Science and Technology*, Summer, online at < http://www.issues.org/20.4/preston.html >.

> Anne E. Preston is associate professor of economics at Haverford College. This article is adapted from Preston (2004).

Preston, A.E. 2004. *Leaving Science: Occupational Exit from Scientific Careers*. Russell Sage, publishers information at < http://www.russellsage.org/publications/books/0-87154-694-9 >.

*Prince, M. 2004. "Does Active Learning Work? A Review of the Research," *Journal of Engineering Education* **93**(3): 223-231; online at < http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Prince_AL.pdf > (752 kB).

Pritchard. P.A., ed. 2005. *Success Strategies for Women in Science: A Portable Mentor*. Academic Press. Amazon.com information at < http://tinyurl.com/34gvj6 >. Note the "Search Inside" feature.

Proctor, R.N. & L. Schiebinger, eds. 2008. *Agnotology: The Making and Unmaking of Ignorance*. Stanford University Press, publisher's information at < http://www.sup.org/book.cgi?book_id=5652%205901 >.

A preliminary Table of Contents is online at < http://tinyurl.com/568jdd > - there we learn that "agnotology" is "a missing term to describe the cultural production of ignorance and its study."

A press release is at < http://www.sup.org/html/book_pages/0804759014/Press%20Release.pdf > (104 kB). For a review see "Plenty to Go Around" [Lemee (2008)].

*Project Kaleidoscope. 2006. *Report on reports II. Recommendations for Urgent Action: Transforming America's Scientific and Technological Infrastructure for a Global Economy,* online at < http://www.pkal.org/documents/ReportOnReportsII.cfm >. According to the description by "National Academy of Academic Leadership" at < http://www.thenationalacademy.org/resources/curriculum.html > [NAAL (2008)], *Report on reports II*:

"Reviews the recommendations and the rational behind them of nearly 20 recent reports addressing America's capacity as a world leader in addressing societal problems through scientific and technological innovation. Must reading for anyone involved in the design of courses and curricula in business, engineering and science."

Pugel, D.E. 1997. "Points of Derailment: The Making of a Female Physicist," *APS Physics and Society Newsletter*, July; online at < http://www.aps.org/units/fps/newsletters/1997/july/ajul97.html#a3 > : An insightful discussion of the cradle-to-tenure derailment threats for females in physics. At the time Pugel was as a graduate student at the James Franck Institute, University of Chicago. She writes:

"Becoming a physicist should be about becoming a person: a bright, competitive innovator in touch with nature. This genderless approach, where we acknowledge people, not men or women, has been mentioned as a possible solution to the small number of women in physics. This is a lofty goal that requires generations of change. Right now, we are far from a gender-free society and must deal with the current conditions. . . . Our young physicist . . . must act upon her ideals and promote change at several levels. . . .(be) aware of the struggles involved, . . . stay on course in pursuit of her heart's desire, work within a system in transition and seek to change not only her understanding of nature's interactions, but interactions among members in her field."

Quigley, M.W. & L. Kaufman. 2004. *Going Back To Work: A Survival Guide for Comeback Moms*. St. Martins Griffin, Amazon.com information at < http://tinyurl.com/3plw9m >. Note the "Search Inside" feature. See the review by Reilly (2007a).

*Raimi, R.A. 2004. "Uncivil War," *Education Next*, Spring, online at < http://www.educationnext.org/20042/81.html >, a review of *California Dreaming: Reforming Mathematics Education* [Wilson (2003)]. Mathematician Raimi wrote:

"California's 'math wars,' the struggle over what is sometimes called the 'new New Math,' illustrate all the ills and disagreements that have plagued American education for the past century. They have been but a chapter in the efforts by 'progressive' educators to legislate equality of results in the schools via the dumbing down of the curriculum. In place of academic achievement, progressives offer self-esteem and racial harmony as the principal prizes, though there are others, especially for the bloated education establishment itself."

Raymond, C.L, & C.P. Benbow. 1986. "Gender differences in mathematics: A function of parental support and student sex typing?" *Developmental Psychology* **22**(6): 808-819.

#LPE *RealClimate. 2008. "Climate science for climate scientists," online at < http://www.realclimate.org/ > and < http://www.realclimate.org/index.php/archives/2007/05/start-here/ >.

*Redish, E. F. 1994. "Implications of cognitive studies for teaching physics," *Am. J. Phys.* **62**(9): 796-803; online at < http://www.physics.umd.edu/perg/papers/redish/cogsci.html >.

*Redish, E.F. 1999. "Millikan Award Lecture 1998: Building a Science of Teaching Physics," *Am. J. Phys.* **67**(7): 562-573; online at < http://www.physics.umd.edu/perg/papers/redish/millikan.htm >.

#EB *Redish, E.F. 2006. "Re: Can Neuroscience Benefit Classroom Instruction?" PhysLrnR post 15 Oct 2006 22:12:17-0400; online at < http://tinyurl.com/tqzhe >. In the last sentence, the URL for Redish's American Association of Physics Teachers (AAPT) talk "How having a theory of learning changes what I do in class on Monday," should have been given as < http://www.physics.umd.edu/perg/talks/redish/Monday.pdf > (2.1 MB).

Reid, N. 2003. "Gender and physics," *International Journal of Science Education* **25**(4): 509-536, online to subscribers at < http://tinyurl.com/yogcdd >.

Reilly, M. 2006. Review of *Rosalind Franklin: The Dark Lady of DNA* [Maddox (2002)], *AWIS Magazine*, Spring, online at < http://www.awis.org/pubs/magazine/35-2/bookreview.pdf > (200 kB).

Reilly, M. 2007a. "Going Back to Work" [Review of Quigley & Kauman (2004)], *AWIS Magazine*, Summer, online at < http://www.awis.org/pubs/documents/Summer2007pdf_000.pdf > (4.2 MB).

#SDMA Reilly, M. 2007b. "Women in STEM Careers" [Review of Byers & Williams (2006), Marzabadi *et al*. (2006), & Ceci & Williams (2006)], *AWIS Magazine*, Spring, online at < http://www.awis.org/pubs/documents/AWISmagSpring2007.pdf > (2.8 MB).

Reilly, M. 2007c. "Girls and Information Technology" [Review of Cohoon & Aspray (2007)], *AWIS Magazine*, Winter, online at < http://www.awis.org/pubs/documents/Awis_Winter2007_000.pdf > (3.2 MB).

Reis, R. 1999a. Tomorrow's Professor Msg. #89. "Women Faculty Model New Values For Research Universities"; online at the archives
< http://cgi.stanford.edu/~dept-ctl/cgi-bin/tomprof/postings.php >.
Summary by James Yao at Texas A & M University of an article by Helen Astin (Associate Director and Professor) and Christine Cress (Research Analyst) of the UCLA Higher Education Research Institute < http://www.gseis.ucla.edu/heri/index.php >, presented at the November 1998 conference on "Women in Research Universities" at Harvard University.

Reis, R. 1999b. Tomorrow's Professor Msg.#166. "Women In Academe"; online at the archives < http://cgi.stanford.edu/~dept-ctl/cgi-bin/tomprof/postings.php >. Excerpted from an article in the 11 October 1999 issue of "*Salon.com*" by Ann Douglas, who teaches cultural history at Columbia University.

Reis, R. 2000. Tomorrow's Professor Msg.#225. "The Temporal Dimension of Gender Inequality In Academia"; online at the archives
< http://cgi.stanford.edu/~dept-ctl/cgi-bin/tomprof/postings.php >. This is an excerpt from Chapter 5, "The subtle ways of differential treatment," pp. 73-76, in Toren (2000).

Reis, R. 2001. Tomorrow's Professor Msg. #361. "Opening To Diversity: Women And Minorities"; online at the archives
< http://cgi.stanford.edu/~dept-ctl/cgi-bin/tomprof/postings.php >. Excerpted from Chapter 2, "Campus Lives in Perspective: Historical Snapshots," in Spitzberg & Thorndike (1992).

Reis, R. 2006. Tomorrow's Professor, Message #717, "Proof and Prejudice: Women in Mathematics," 21 April, online at the archives
< http://cgi.stanford.edu/~dept-ctl/cgi-bin/tomprof/postings.php >. This includes a reprint of "Biases must be tackled to achieve gender equity in mathematics, scholars argue" [Trie (2006)]. See also the discussion-list post on this message by Hake (2006a).

Rennie, L. & L. Parker. 1998. "Equitable Measurement of Achievement in Physics High School Students' Responses to Assessment Tasks in Different Formats and Contexts," *Journal of Women and Minorities in Science and Engineering* **4**(2 &3).

#CE *Resnick, L.B. and Hall, M.W. 1998. "Learning Organizations for Sustainable Education Reform," *Daedalus* **127**(4): 89-118; ,online at
< http://ifl.lrdc.pitt.edu/ifl/media/pdf/learningorgforsustain.pdf > (168 kB):

"Broadly speaking, cognitive science confirms Piaget's claim that people must *construct* (*italics* in the original) their understanding; they do not simply register what the world shows or tells them, as a camera or a tape recorder does. To 'know' something, indeed even to memorize effectively, people must build a mental representation that imposes order and coherence on experience and information.. . . . . Early on, however, cognitive scientists found that they could not account for problem solving and learning without attending to what people already *knew* (*italics* in the original). Vast knowledge of possible positions in a chess game, they found – not a superior ability to 'think ahead' – was what distinguished chess masters from merely good chess players. In every field of thought, cognitive scientists found that knowledge is essential to thinking and acquiring new knowledge - in other words to learning. . . These repeated findings about the centrality of knowledge in learning make perfect sense for a constructivist theory of learning, because one has to have something with which to construct. . . . .they insist that knowledge - *correct* knowledge (*italics* in the original) - is essential at every point in learning. And they make it impossible to suggest that education for the information age should not trouble itself with facts and information, but only with processes of learning and thinking. What we know now is that just facts alone do not constitute true knowledge and thinking power, so thinking processes cannot proceed without something to think about. Knowledge is in again, but alongside thinking, indeed, intertwined with it, not instead of thinking. So although it is essential for children to have the experience of discovering and inventing, their experience must be of one of disciplined invention, that is, by established processes of reasoning and logic. [The above advocated] *Knowledge-based Constructivism*, taken seriously, *points to a position that can moderate the century-long polarity between passive drill pedagogies and child-centered discovery pedagogies*." [Our *italics*.]

**Review of Educational Research*. 2008. Online at < http://rer.sagepub.com/ >; archives at
< http://rer.sagepub.com/archive/ >.

Ride, S. 2008. Sally Ride Science; online at
< http://www.sallyridescience.com/home >. [See Butler (2002) for an interview with Sally Ride.]

#AA Rolison, D.R. 2003. "Can Title IX Do for Women In Science and Engineering What It Has Done for Women In Sports?" APS News, May, online at
< http://www.aps.org/publications/apsnews/200305/backpage.cfm >.

#EB *Roediger. H.L. , Y. Dudai, & S.M. Fitzpatrick, eds. 2007. *Science of Memory: Concepts*. Oxford University Press, publisher's information at < http://tinyurl.com/6ao2zc > :

"Scientists currently study memory from many different perspectives: neurobiological, ethological, animal conditioning, cognitive, behavioral neuroscience, social, and cultural. The aim of this book is to help initiate a new science of memory by bringing these perspectives together to create a unified understanding of the topic. The book began with a conference where leading practitioners from all these major approaches met to analyze and discuss 16 concepts that are crucial to our understanding of memory. Each of these 16 concepts is addressed in a section of the book, and in the 66 succinct chapters that fill these sections, a leading researcher addresses the section's concept by clearly stating his or her position on it, elucidating how it is used, and discussing how it should be used in future research. For some concepts, there is general agreement among practitioners from different fields and levels of analysis, but for others there is general disagreement and much controversy. A final chapter in each section, also written by a leading researcher, integrates the various viewpoints offered on the section's concept, then draws conclusions about the concept. This groundbreaking volume will be an indispensable reference for all the students and researchers who will build upon the foundation it provides for the new science of memory."

#LPE Romer, R.H. 1988. "Editorial: 958 men, 93 women – How many Lise Meitners among those 865?" *Am. J. Phys.* **56**(10): 873; online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=56&Issue=10 >. See also the valuable response by Button-Shafer (1990). Pertinent to Part 2, Section C2 of this tract, one might also ask "*How many Rachel Carsons are among them*?" – see < http://www.rachelcarson.org/ >"

Rosenbloom, J.L., R.A. Ash, B. Dupont, & L. Coder, in press, "Why Are There so Few Women in Information Technology? Assessing the Role of Personality in Career Choices," *Journal of Economic Psychology*. A corrected proof is online to subscribers at < http://tinyurl.com/5b7whq >. A draft of 22 September 2006 is free online at < http://people.ku.edu/~jrosenbloom/ITWF_why.pdf > (388 kB). The abstract reads:

Despite increases in female labor force participation, women remain substantially under represented in most scientific and technical fields. The small number of women in engineering, physics, chemistry, computer science and other similar fields has variously been attributed to discrimination, differences in ability or choice. This paper uses a unique data set containing information on vocational interests to examine the determinants of entry in to Information Technology Occupations. We show that men and women differ systematically in their interests, and that these differences can account for an economically and statistically large fraction of the occupational gender gap.

Rosser, Sue V. 2008. Homepage at Georgia Tech,
< http://www.spp.gatech.edu/faculty/faculty/srosser.php > :

She has edited collections and written approximately 120 journal articles on the theoretical and applied problems of women, science, and technology and women's health. She is author of nine books: *Teaching Science and Health from a Feminist Perspective: A Practical Guide* (1986); *Feminism within the Science and Health Care Professions: Overcoming Resistance* (1988); *Female-Friendly Science* (1990); *Feminism and Biology: A Dynamic Interaction* (1992); *Women's Health: Missing from U.S. Medicine* (1994); *Teaching the Majority* (1995); *Re-engineering Female Friendly Science* (1997); *Women, Science, and Society: The Crucial Union* (2000); and *The Science Glass Ceiling: Academic Women Scientists and the Struggle to Succeed* (2004). Her latest co-edited book is *Women, Gender, and Technology* (2006). . . .[Fox, Johnson, & Rosser (2006)]. . . . .

Rosser, S.V. 2001. "Will EC 2000 make Engineering More Female Friendly?" Women's Studies Quarterly **29**(4). [EC 2000 refers to "Engineering Criteria 2000," the new accreditation guidelines for technical degree-granting universities developed by the Accreditation Board for Engineering and Technology (ABET) < http://www.abet.org/ >.

Rosser, S.V. 2002. "A Shift in Focus from Individual to Institutional Solutions to Attract and Retain Women in Science and Engineering." *AWIS Magazine*. Winter; online to subscribers at < http://www.awis.org/pubs/magazine/members/31-1/naughton.pdf > (12 kB).

Rosser, S.V. & E.O. Lane. 2002. "Key Barriers For Academic Institutions Seeking To Retain Female Scientists And Engineers: Family-Unfriendly Policies. Low Numbers, Stereotypes, And Harassment," *J. Women and Minorities in Sci. and Eng*. 8(2), 163 (2002); abstract online at < http://tinyurl.com/3ggroa >.

Rosser, S.V. 2004. *The Science Glass Ceiling: Academic Women Scientists and the Struggle to Succeed*. Routledge. Amazon.com information at < http://tinyurl.com/2wy67v >. Note the "Search Inside" feature.

Rosser, S.V., J.Z. Daniels, & L. Wu. 2006. "Institutional Factors Contributing To Dearth Of Women STEM Faculti (sic): Classification And Status Matter; Location Doesn't ," *J. Women and Minorities in Sci. and Eng*. **12**(1): 79-93; abstract online at < http://tinyurl.com/48unhe >.

Rosser, S.V. 2006. "Senior Women Scientists Overlooked And Understudied?" *J. Women and Minorities in Sci. and Eng*. 12(4): 275-293; abstract online a < http://tinyurl.com/54mx3u >.

Rosser, S.V., ed. 2008. *Women, Science, and Myth: Gender Beliefs from Antiquity to the Present*. ABC-CLIO, publisher's information at
< http://www.abc-clio.com/products/overview.aspx?productid=110240&viewid=1 >.

Rossi, A. 1965. "Women in science: Why so few?" *Science* **148**(3674): 1196-1202, abstract online at < http://www.sciencemag.org/cgi/content/abstract/148/3674/1196 >. The abstract reads:

"American society has prided itself on its concern for the fullest development of each individual's creative potential. As a nation, we have become sensitive to the social handicaps of race and class but have remained quite insensitive to those imposed because of sex. Those women who have entered the top professional fields have had to have extraordinary motivation, thick skins, exceptional ability, and some unusual pattern of socialization in order to reach their occupational destinations. In their backgrounds one is likely to find a professional mother, an unusually supportive father, or dedicated and stimulating teachers."

Alice Rossi is an Emeritus Professor of Sociology at the University of Massachusetts - Amherst, one of the founders of the National Organization for Women (NOW), and the seventy-fourth president of the American Sociological Association.

Rossiter, M.W. 1982. *Women Scientists in America: Struggles and Strategies to 1940.* Johns Hopkins University Press, publisher's information at < http://www.press.jhu.edu/books/title_pages/3061.1.html >.

Rossiter, M.W. 1993. "The Matthew Matilda Effect in Science," in *Social Studies of Science* **23**: 325-341, an abstact is online at < http://sss.sagepub.com/cgi/content/abstract/23/2/325?ck=nck > :

"Recent work has brought to light so many cases, historical and contemporary, of women scientists who have been ignored, denied credit or otherwise dropped from sight that a sex-linked phenomenon seems to exist, as has been documented to be the case in other fields, such as medicine, art history and literary criticism. Since this systematic bias in scientific information and recognition practices fits the second half of Matthew 13:12 in the Bible, which refers to the under-recognition accorded to those who have little to start with, it is suggested that sociologists of science and knowledge can add to the 'Matthew Effect', made famous by Robert K. Merton in 1968, the 'Matilda Effect', named for the American suffragist and feminist critic Matilda J. Gage of New York, who in the late nineteenth century both experienced and articulated this phenomenon. Calling attention to her and this age-old tendency may prod future scholars to include other such 'Matildas' and thus to write a better, because more comprehensive, history and sociology of science."

Rossiter, M.W. 1995. *Women Scientists in America: Before Affirmative Action 1940-1972.* Johns Hopkins University Press, publisher's information at < http://www.press.jhu.edu/books/title_pages/3061.2.html >.

*Rothman, F.G. & J.L. Narum. 1999. *Then, Now, & In the Next Decade: A Commentary on Strengthening Undergraduate Science, Mathematics, Engineering and Technology Education.* Project Kaleidoscope; online at < http://www.pkal.org/documents/then-now-and-in-the-next-decade.pdf > (1 MB). The Executive Summary concludes:

> ". . . . from careful assessment of new approaches, there is a growing body of knowledge about what works in strengthening student learning. The challenge now is to expand current efforts making a difference into more colleges and universities across the country. To make this happen as a nation we need to:
>
> a. agree on the salient features and *raison d'être* of strong undergraduate SME&T programs,
>
> b. identify and support faculty, curricula and institutions with demonstrable success in attracting and sustaining interest of all students in SME&T, and facilitate widespread adaptation of best practices,
>
> c. document meticulously the impact of new pedagogies, technologies and practices on student learning,
>
> d. establish what it will cost, at the local and national level, to make an investment in undergraduate SME&T that will truly make a difference in the next decade.

SDMA Ruskai, M.B. 1991. "Guest Comment: Are there innate cognitive gender differences? Some comments on the evidence in response to a letter from M. Levin," *Am. J. Phys.* **59**: 11-14; online at < http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=59&Issue=1 >.

#SSG Sadker, M, & D. Sadker. 1995. *Failing At Fairness: How Our Schools Cheat Girls.* Scribner. Amazon.com information at < http://www.amazon.com/Failing-At-Fairness-Schools-Cheat/dp/068480073X >. Note the "Search Inside" feature.

Sadker, M, & E.S. Silber, eds. 2006. *Gender in the Classroom: Foundations, Skills, Methods, and Strategies Across the Curriculum.* Lawrence Erlbaum. Amazon.com information at < http://tinyurl.com/3s2gd2 >.

Sax, L.J. & Harper, C. 2007. "Origins of the gender gap: Pre-college and college influences on the differences between men and women," *Research in Higher Education* **48**(6): 669-694.

#FSP Schiebinger. L. 1989. *The Mind Has No Sex? Women in the Origins of Modern Science.* Harvard University Press, publisher's information at < http://www.hup.harvard.edu/catalog/SCHMIN.html >.

#FSP Schiebinger, L. 2001. *Has Feminism Changed Science?*. Harvard University Press; publisher's information at < http://www.hup.harvard.edu/catalog/SCHHAS.html >.

#FSP Schiebinger, L. 2004. *Nature's Body: Gender In The Making Of Modern Science.* Rutgers University Press, 2nd edition. Amazon.com information at < http://tinyurl.com/3aeht6 >. Note the "Search Inside" feature.

#FSP Schiebinger, L. ed. 2008. *Gendered Innovations in Science and Engineering*. Stanford University Press, publisher's information at
< http://www.sup.org/book.cgi?book_id=5814%205815%20 >.
The introduction "Getting more Women in to Science: Knowledge Issue" is online at
< http://www.stanford.edu/group/gender/People/schiebinger_sg.pdf > (160 kB).

#FSP Schiebinger, Londa. 2008. Homepage at Stanford
< http://www.stanford.edu/dept/HPST/schiebinger.html >.

#IC *Schmidt, W.H. & C. C. McKnight. 1998. "What Can We Really Learn from TIMSS?" *Science* **282**: 1830–1831; abstract online at
< http://www.sciencemag.org/cgi/content/summary/282/5395/1830?ck=nck > :
"Important policy implications regarding American mathematics and science education are available through the results of the Third International Mathematics and Science Study (TIMSS). This is especially true if the results from all parts of the study including those pertaining to curriculum and instructional practices are combined with those related to the achievement testing in grades three, four, seven, eight and the end of secondary school. The decline in relative standing for the U.S. from grade four to grade 12 in both mathematics and science achievement is clear as are the corresponding differences in intellectual rigor in the U.S. curriculum as compared to that of the top achieving countries, especially during the middle and high school years."

#IC *Schmidt W.H, S. Raizen , E.D. Britton, L.J. Bianchi, R.G. Wolfe. 1997. "*Many Visions, Many Aims (TIMSS Volume 3) - A Cross-National Investigation of Curricular Intention.*" Springer. Amazon.com information at < http://tinyurl.com/cpk59 >.

#IC *Schmidt, W.H., C.C. McKnight, & S.A. Raizen. 1997. "A Splintered Vision: An Investigation of U.S. Science and Mathematics Education." Amazon.com information at
< http://tinyurl.com/4vopby >. Executive summary online at
< http://ustimss.msu.edu/splintrd.htm >.

#IC *Schmidt W.H., C.C. McKnight, R.T. Houang, H.C. Wang, D. Wiley, L.S. Cogan, R.G. Wolfe. 2001. "*Why Schools Matter: A Cross-National Comparison of Curriculum and Learning*." Jossey-Bass. Amazon.com information at < http://tinyurl.com/7esac >.

Schneider, M.B. 2001. "Encouragement of Women Physics Majors at Grinnell College: A Case Study," *Phys. Teach.* **39**(5): 280-282; online to subscribers as
< http://scitation.aip.org/dbt/dbt.jsp?KEY=PHTEAH&Volume=39&Issue=5 >.

*Schoenfeld, A.H. 1992. "Learning to think mathematically: Problem solving, metacognition, and sense-making in mathematics," in D. Grouws, ed. *Handbook for Research on Mathematics Teaching and Learning* (pp. 334-370). MacMillan; online at < http://gse.berkeley.edu/faculty/ahschoenfeld/Schoenfeld_MathThinking.pdf > (1.1 MB). Schoenfeld wrote [see his article for the references, our *italics*]:

> An emerging body of literature (see, e.g., Bauersfeld, 1979; Brown, Collins, & Duguid, 1989; Collins, Brown, and Newman, 1989; Lampert, in press; Lave, 1988; Lave, Smith, & Butler, 1989; Greeno, 1989; Resnick, 1989; Rogoff & Lave, 1984; Schoenfeld, 1989a, in press; see especially Carraher's chapter in this volume) conceives of mathematics learning as an inherently social (as well as cognitive) activity, *an essentially constructive activity instead of an absorbtive one*. By the mid-1980's, *the constructivist perspective* -- with roots in Piaget's work (e.g. Piaget, 1954), and with contemporary research manifestations such as the misconceptions literature (Brown & Burton, 1978; diSessa, 1983; Novak, 1987) – *was widely accepted in the research community as being well grounded*. Romberg and Carpenter (1986) stated the fact bluntly: "The research shows that learning proceeds through construction, not absorption" (p. 868). *The constructivist perspective pervades this Handbook as well*. . . . . However, the work cited in the previous paragraph extends the notion of constructivism from the "purely cognitive" sphere, where much of the research has been done, to the social sphere. As such, it blends with some theoretical notions from the social literature. Resnick, tracing contemporary work to antecedents in the work of George Herbert Mead (1934) and Lev Vygotsky (1978), states the case as follows: "Several lines of cognitive theory and research point toward the hypothesis that we develop habits and skills of interpretation and meaning construction though a process more usefully conceived of as socialization than instruction" [Resnick, 1989, p. 39)].

*Schoenfeld, A.H., J. Kaput, & E. Dubinsky, eds. 1998. "Research in Collegiate Mathematics Education. III." American Mathematics Society, publishers information at < http://www.ams.org/bookstore-getitem/item=CBMATH-7 >. A Google "book preview" is online at < http://tinyurl.com/3fwfmh >.

*Schoenfeld, A.H. 2003. "The Math Wars," in *Educational Policy* **18**(1): 253-286; online at < http://gse.berkeley.edu/faculty/AHSchoenfeld/Schoenfeld_MathWars.pdf >. The abstract reads:

> "During the 1990s, the teaching of mathematics became the subject of heated controversies known as the math wars. The immediate origins of the conflicts can be traced to the 'reform' stimulated by the National Council of Teachers of Mathematics' Curriculum and Evaluation Standards for School Mathematics. Traditionalists fear that reform-oriented, 'standards-based' curricula are superficial and undermine classical mathematical values; reformers claim that such curricula reflect a deeper, richer view of mathematics than the traditional curriculum. An historical perspective reveals that the underlying issues being contested—Is mathematics for the elite or for the masses? Are there tensions between 'excellence' and 'equity'? Should mathematics be seen as a democratizing force or as a vehicle for maintaining the status quo?—are more than a century old. This article describes the context and history, provides details on the current state, and offers suggestions regarding ways to find a productive middle ground."

For more on the Math Wars see *California Dreaming: Reforming Mathematics Education* [Wilson (2003)].

For the "Science Wars" see "Guest Comment: The science wars" [Newton (1998)] and *The One Culture? A Conversation about Science* [Larbinger *et al*. (2001)].

Schuck, J.A. 1997. "Factors contributing to the Under-Representation of Women in Physics-Based Engineering Fields." A.P. Sloan Foundation Report, Ithaca, NY. This report was not found at the Sloan Foundation website < http://www.sloan.org/main.shtml >.

*Schwartz, D.L. & J.D. Bransford, 1998. "A time for telling," *Cognition & Instruction* **16**: 475-522; an abstract is online at < http://tinyurl.com/2ue7fj >. See also "In Defense of Lecturing" [Burgan (2006)].

**Science Magazine*. 2008a. Online at < http://www.sciencemag.org/magazine.dtl >. Advanced search < http://www.sciencemag.org/search.dtl >.

Science Magazine. 2008b. Women in Science: A search for the phrase "Women in Science" in the title or abstract at the Science Magazine search engine < http://www.sciencemag.org/search.dtl > yielded 119 hits on 5 April 2008. Except for Handelsman *et al*. (2005), only those for 2007 & 2008 are listed in this compilation.

**Science, Technology, and Society*. 2007. Online at < http://sts.sagepub.com/ >. Archives online at < http://sts.sagepub.com/archive/ > :

> "*Science, Technology & Society* enhances our understanding of the way in which advances in science and technology influence society and vice versa. Launched in 1996, it is the first truly international journal devoted to the developing world and published from the region. It covers areas like history, sociology, philosophy, economics, political science, psychology, technological forecasting, science policy, R & D management, health & nutrition, agriculture, ecology & environment, and quantitative studies."

*Seaman, R. 2003. Review of *The Mathematical Education of Teachers* [CBMS (2001)]; the MAA Online book review column, online at < http://www.maa.org/reviews/METreport.html >.

Selby C.C. ed. 1999. *Women in science and engineering: Choices for success*. New York Academy of Sciences, publisher's information at < http://www.nyas.org/annals/detail.asp?annalID=655 >.

Sergeant, R. 1995. "Can a Culture Change? The CfPA and the "Chilly Climate" *APS News* **4**(11), December; online at < http://www.aps.org/publications/apsnews/199512/cfpa.cfm >. Sergeant wrote:

> "Can a Culture Change?" was the question explored during a two-hour presentation given by the Center for Particle Astrophysics (CfPA) during the 1995 APS March Meeting in San Jose, CA, sponsored by the APS Committee on Education. The invited panel, all CfPA members, spoke about their efforts to develop an environment that is responsive to the cultural issues of isolation, sexism, low self-esteem, unhealthy competition, and the struggle to balance career and family. These and other issues are recognized as major contributing factors to the "chilly climate" in physics.

Seymour, E. 1992. 'The Problem Iceberg' in Science, Mathematics, and Engineering Education: Student Explanations for High Attrition Rates." *Journal of College Science Teaching*, February, pp. 230-232. ERIC abstract at < http://tinyurl.com/427a27 >.

Seymour, E. 1995. "Guest Comment: Why undergraduates leave the sciences." *Am. J. Phys.* **63** (3): 199-202; online to subscribers at
< http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=63&Issue=3 >.

Seymour, E. & N. Hewitt. 2000. *Talking about Leaving: Why Undergraduates Leave the Sciences*. Westview Press. Amazon.com information at < http://tinyurl.com/5dmstv >. Note the "Search Inside" feature.

*Shadish, W.R., T.D. Cook, & D.T. Campbell. 2002. *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Houghton Mifflin - information at
< http://tinyurl.com/y3e7vw >. A goldmine of references to social-science research.

*Shavelson, R.J. & L. Towne, eds., 2002. *Scientific Research in Education*, National Academy Press; online at < http://www.nap.edu/catalog/10236.html >.

*Shavelson, R.J. & L. Huang. 2003. "Responding Responsibly To the Frenzy to Assess Learning in Higher Education," *Change Magazine*, January/February; online at
< http://www.stanford.edu/dept/SUSE/SEAL/ > as the first "highlighted" paper.

*Shavelson, R.J. 2008. "Formative Assessment," Guest Editor's Introduction, special issue *Applied Measurement in Education*, in press; online at
< http://www.stanford.edu/dept/SUSE/SEAL/ >.

Five articles on formative assessment to appear in *Applied Measurement in Education* are at this same site. Note that they: (a) are primarily concerned with K-12, (b) do not use "formative" in the same sense as the "Joint Committee on Standards for Educational Evaluation" [JCSEE (1994)] and as used by Hake (2007j)]: "Formative evaluation is evaluation designed and used to improve an object, especially when it is still being developed."

Sher, M. 2006. "New Website Lets Visitors Assess 'Female-friendliness' of Graduate Departments," *APS News*, February, online at
< http://www.aps.org/publications/apsnews/200602/viewpoint.cfm >. See above under APS (2008), Women in Physics Programs, (f) Female Friendly Physics Graduate Programs
< http://www.aps.org/programs/women/female-friendly/index.cfm >.

#EB *Shermer, M. 2008. "The Brain Is Not Modular: What fMRI Really Tells Us: Metaphors, modules and brain-scan pseudoscience," *Scientific American*, May; online at
< http://www.sciam.com/article.cfm?id=a-new-phrenology&sc=rss >. [fMRI = functional magnetic resonance imaging.]

Signs: Journal of Women in Culture and Society. 2008. Homepage at
< http://www.journals.uchicago.edu/toc/signs/current >

Simpson, B. 1996. "Science Majors - Aptitude, Interest, and Commitment: A Profile of 10 Years of Female Biology, Chemistry, Physics, and Mathematics Students at a Private, Liberal Arts College," GASAT 8; online at < http://archive.wigsat.org/gasat/40.txt >. See GASAT #8 (1996).

Sjøberg, S. and G. Imsen. 1988. "Gender and science education I," in P. Fensham, ed. , *Development and Dilemmas in Science Education*, Falmer Press, pp. 218-248. Amazon.com information at < http://tinyurl.com/5583gb >. Note the "Search Inside" feature. [See also Kahle (1988a) in the same volume.]

*Smart, J.C., ed. 1985-2007. *Higher Education: Handbook of Theory and Research*, vol. 1-22. Springer, publisher's information at < http://www.springer.com/series/6028 > :

Published annually since 1985, the *Handbook* series provides a compendium of thorough and integrative literature reviews on a diverse array of topics of interest to the higher education scholarly and policy communities. Each chapter provides a comprehensive review of research findings on a selected topic, critiques the research literature in terms of its conceptual and methodological rigor, and sets forth an agenda for future research intended to advance knowledge on the chosen topic. The *Handbook* focuses on twelve general areas that encompass the salient dimensions of scholarly and policy inquiries undertaken in the international higher education community. Each annual volume contains manuscripts on such diverse topics as research on college students and faculty, governance and planning, advances in research methodology, economics and finance, and curriculum and instruction. The series is fortunate to have attracted annual contributions from distinguished scholars throughout the world.

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b. Hundreds of citations in a wide range of scholarly journals, including all leading journals of higher education and many other social science and professional journals -
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Published annually since 1985.

ABSTRACTS

a. volume 1 (1985) to 19 (2004) < http://tinyurl.com/6zfp6q >;
b. volume 20 (2005) at < http://tinyurl.com/5ovdqt >;
c. volume 21 (2006) at < http://tinyurl.com/5gwqtk >;
d. volume 22 (2007) at < http://tinyurl.com/4d69xw >.

*Smart, J.C., ed. 2008. *Higher Education: Handbook of Theory and Research*, vol. 23. Springer, publisher's information at < http://tinyurl.com/44zpve > (not yet published. Table of contents at < http://tinyurl.com/4zyosl >.

#IE *Smith, K.A., S. D. Sheppard, D.W. Johnson, & R.T. Johnson. 2005. "Pedagogies of Engagement: Classroom-Based Practices," *Journal of Engineering Education* **94**(1): 87-102; online as a 492 kB pdf at < http://tinyurl.com/y939x2 >. They write [our inserts at ". . . .[*insert*]. . ."]:

"Research that has had a significant influence on the instructional practices of engineering faculty is Hake's (1998a,b) comparison of students' scores on the physics Force Concept Inventory (FCI), a measure of students' conceptual understanding of mechanics, in traditional lecture courses and interactive engagement courses. The results shown for high school (HS), college (COLL), and university (UNIV) students in. . .[Fig. 1 of Hake (1998a)]. . . show that student-student interaction during class time is associated with a greater percent . . . .[*normalized*]. . . gain on the FCI. Further study of the figure shows that even the best lectures. . . .[more accurately the "best traditional courses" since *non-passive* student lectures such those by Mazur [Crouch & Mazur (2001)] yield relatively high normalized gains]. . . achieve student gains that are at the low end of student . . . .[*normalized*]. . . gains in interactive engagement classes."

#SSB Smith, M.W. & J.D. Wilhelm. 2002. "*Reading Don't Fix No Chevy's: Literacy in the Lives of Young Men*. Heinemann, publisher's information at
< http://books.heinemann.com/products/0509.aspx > :

"Through a variety of creative research methods and an extended series of interviews with 49 young men in middle and high school who differ in class, race, academic achievement, kind of school, and geography, the authors identified the factors that motivated these young men to become accomplished in the activities they most enjoyed—factors that marked the boys' literate activities outside of school, but were largely absent from their literate lives in school. Their study questions the way reading and literature are typically taught and suggests powerful alternatives to traditional instruction."

*Snow, C.P. 1959. *The two cultures and the scientific revolution*. Available in a 1993 "Canto" edition tiled "The Two Cultures," illustrated by Stefan Collini and published by Cambridge University Press, publisher's information at
< http://www.cambridge.org:80/uk/catalogue/catalogue.asp?isbn=9780521457309 > :

"The notion that our society, its education system and its intellectual life, is characterised by a split between two cultures - the arts or humanities on one hand, and the sciences on the other - has a long history. But it was C. P. Snow's Rede lecture of 1959 that brought it to prominence and began a public debate that is still raging in the media today. This reissue of *The Two Cultures* and its successor piece, *A Second Look* (in which Snow responded to the controversy four years later) has a new introduction by Stefan Collini, charting the history and context of the debate, its implications and its afterlife. The importance of science and technology in policy run largely by non-scientists, the future for education and research, and the problem of fragmentation threatening hopes for a common culture are just some of the subjects discussed."

Social Studies of Science. 2008. Online at < http://sss.sagepub.com/ >. Archives at
< http://sss.sagepub.com/archive/ >.

Social Science Quarterly. 2008. Online at
< http://www.blackwellpublishing.com/journal.asp?ref=0038-4941&site=1 >; archives at
< http://www.blackwell-synergy.com/loi/SSQU?cookieSet=1 >.

Society of Women Engineers. 2008. Online at
< http://www.swe.org/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=5 >.

Sokoloski, J.L. 2005. "Progress on Gender Equity at Nine Top Research Universities," *STATUS*, January, online at < http://www.aas.org/cswa/status/statusJan05sm.pdf > (672 kB).

Sommers, C.H. 1995. *Who Stole Feminism? How Women Have Betrayed Women*. Simon & Schuster. Amazon.com information at
< http://www.amazon.com/Who-Stole-Feminism-Women-Betrayed/dp/0684801566 >. Note the "Search Inside" feature.

From Library Journal:

In this jeremiad, Sommers (philosophy, Clark Univ.) takes out after anti male "gender feminists" who willfully, she contends, distort information on women's status to keep their lock on government and foundation money. Their dark agenda includes silencing sensible "equity feminists," who celebrate women's achievements and who seek, in partnership with men, to make the few minor adjustments needed for perfect equity. Her chief disagreement with "gender feminists" concerns their belief that gender bias is so ingrained that we are frequently unaware of its influence. Unfortunately, Sommers's scornful tone makes her reporting suspect; she mocks the arguments she opposes rather than engaging and refuting them. She is strongest when she criticizes the methodology of some well-known feminist research, but she undermines her credibility when she fails to apply her own standards to studies that suit her position. This book will have as an audience readers who share her politics.

Cynthia Harrison, Federal Judicial Ctr., Washington, D.C.

#SSB Sommers, C.H. 2001. *The War Against Boys: How Misguided Feminism Is Harming Our Young Men,* Simon & Schuster. Amazon.com information at
< http://tinyurl.com/6mx4kc >. According to
< http://en.wikipedia.org/wiki/Christina_Hoff_Sommers > :

Christina Hoff Sommers, Ph.D. (born 1950) is an American author who researches culture, adolescents, and morality in American society. . . . .A former philosophy professor in Ethics at Clark University in Worcester, Massachusetts, she is a resident scholar at the American Enterprise Institute. . . . . [< http://www.aei.org/ >]. . . . for Public Policy Research, and a member of the Board of Advisors of the Foundation for Individual Rights in Education. . . [< http://www.thefire.org/ >]. . . .

#SSIGD Sommers, C.H. 2007. "Academic Inquisitors," *Wall Street Journal*, 16 October online at
< http://www.aei.org/publications/pubID.26967,filter.all/pub_detail.asp >. Sommers wrote:

"As if losing the presidency of Harvard for hinting that there might be a biological explanation for the preponderance of men in academic science wasn't enough, Lawrence Summers now appears to be *persona non grata* elsewhere too.

A few weeks ago the University of California, Davis rescinded an invitation for him to speak. More than 150 faculty members signed a petition protesting his appearance, saying Mr. Summers 'has come to symbolize gender and racial prejudice in academia.' Davis ecology Professor Maureen Stanton was 'appalled and stunned that someone like Summers would be invited to speak.'

Ms. Stanton and her allies want pariah status for anyone who dares to suggest a biological basis for difference. Yet the scientific literature on why men and women enter different fields is legitimate, robust, complex and fascinating. What is appalling is that leading academic institutions would try to shut down the discussion and get away with it. Almost.

Last week, the American Enterprise Institute brought together top researchers on sex differences, ranging from the strongly feminist Brandeis women's studies scholar Rosalind Barnett to AEI scholar and co-author of *The Bell Curve,* Charles Murray. . . . .[our insert – see AEI (2007)]. . . . The discussions were heated, but civil. No one got mad, fled the room weeping, or nearly fainted."

Christina Hoff Sommers is an AEI (2008) resident scholar
< http://www.aei.org/scholars/scholarID.56,filter.all/scholar.asp>.

Sommers, C.H. 2008. "Why Can't a Woman Be More Like a Man?: Women earn most of America's advanced degrees but lag in the physical sciences. Beware of plans to fix the 'problem.' " *The American*, March/April; online at < http://tinyurl.com/2bnulg >. Sommers wrote:

> Women now earn 57 percent of bachelors degrees and 59 percent of masters degrees. According to the Survey of Earned Doctorates, 2006 was the fifth year in a row in which the majority of research Ph.D.'s awarded to U.S. citizens went to women. Women earn more Ph.D.'s than men in the humanities, social sciences, education, and life sciences. Women now serve as presidents of Harvard, MIT, Princeton, the University of Pennsylvania, and other leading research universities. But elsewhere, the figures are different. *Women comprise just 19 percent of tenure-track professors in math, 11 percent in physics, 10 percent in computer science, and 10 percent in electrical engineering*. [Our *italics*.] And the pipeline does not promise statistical parity any time soon: women are now earning 24 percent of the Ph.D.'s in the physical sciences—way up from the 4 percent of the 1960s, but still far behind the rate they are winning doctorates in other fields. "The change is glacial," says Debra Rolison. . . .[our insert – see "Can Title IX Do for Women In Science and Engineering What It Has Done for Women In Sports?" (Rolison, 2003)]. . . ., a physical chemist at the Naval Research Laboratory.
>
> [Our insert - With regard to the above italicized sentence, Cathy Kessel, wrote to us on 10 June 2008 (our *italics*]:
>
> > "[Sommers discusses] women in the high echelons of academic math and the physical sciences and states: 'Women comprise just 19 percent of tenure-track professors in math, 11 percent in physics, 10 percent in computer science, and 10 percent in electrical engineering.' These statistics seemed inaccurate to me and I sent an inquiry to the magazine. Sommers was gracious enough to inform me of the source: The *2002* Nelson Diversity Survey < http://cheminfo.ou.edu/~djn/Science_and_Society/index.html > of the '*top 50*' departments, with 'tenure-track' substituted for 'assistant.' Here is a restatement, with statistics from the *2007* Nelson Survey: 'In the '*top 50'* departments, women comprise 28 percent of assistant professors in math, 17 percent in physics, 19 percent in computer science, and 14 percent in electrical engineering.' One might add: "45% in psychology (although women earn about 68% of the Ph.D.s) and 21% in biology (although women earn about 46% of the Ph.D.s). . . . . For statistics on tenure-track professors in mathematics, see the Conference Board of the Mathematical Sciences 2005 and 2000 surveys, online at < http://www.ams.org/cbms/ >".
>
> It would seem that Christina Hoff Sommers is somewhat lax in citing the current literature.

Continuing the quote from Sommers (2008):

> . . . . . .The power and glory of science and engineering is that they are, adamantly, evidence-based. But the evidence of gender bias in math and science is flimsy at best, and the evidence that women are relatively disinclined to pursue these fields at the highest levels is serious. When the bastions of science pay obsequious attention to the flimsy and turn a blind eye to the serious, it is hard to maintain the view that the science enterprise is somehow immune to the enthusiasms that have corrupted other, supposedly "softer" academic fields.
>
> Few academic scientists know anything about the equity crusade. Most have no idea of its power, its scope, and the threats that they may soon be facing. The business community and citizens at large are completely in the dark. This is a quiet revolution. Its weapons are government reports that are rarely seen; amendments to federal bills that almost no one reads; small, unnoticed, but dramatically con-sequential changes in the regulations regarding government grants; and congressional hearings attended mostly by true believers.

American scientific excellence is a precious national resource. It is the foundation of our economy and of the nation's health and safety. Norman Augustine, retired CEO of Lockheed Martin, and Burton Richter, Nobel laureate in physics, once pointed out that MIT alone—its faculty, alumni, and staff—started more than 5,000 companies in the past 50 years. Will an academic science that is quota-driven, gender-balanced, cooperative rather than competitive, and less time-consuming produce anything like these results? So far, no one in Congress has even thought to ask.

[Our insert - among targets that draw Sommers' (2008) fire are: (a) "Can Title IX Do for Women In Science and Engineering What It Has Done for Women In Sports?" (Rolison, 2003)]; (b) the House Committee on Science and Technology; (c) Kathie Olsen, deputy director of the National Science Foundation; (d) Donna Shalala, president of the University of Miami and secretary of health and human services in the Clinton administration; (e) *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering* [[NAP (2007a)]; (f) MIT biologist Nancy Hopkins, "a prominent accuser of Harvard president Lawrence Summers when he committed the solecism of suggesting that men and women might have different propensities and aptitudes"; (g) "ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers" [NSF (2007b)]; (h) "A Study on the Status of Women Faculty at MIT" [MIT (1999)]; and (i) *Why so Slow?* [Valian (1999)]. On the other hand Sommers bestows bouquets on, e.g., (a) the conclusions of Judith Kleinfeld (1999) in her piece "MIT Tarnishes Its Reputation with Gender Junk Science"; (b) *Male, Female: The Evolution of Human Sex Differences* (1998) [Geary (1998)]; (c) *The Blank Slate: The Modern Denial of Human Nature* [Pinker (2003)], and (d) *The Essential Difference: Male And Female Brains And The Truth About Autism* [Baron-Cohen (2004)]].

Sonnert, G. 1996. "Gender Equity in Science: Still an Elusive Goal." *Issues in Science and Technology* **12**(2): 53-58.

Sonnert, G. 1999a. "Women in Science: The Project Access Study," *STATUS*, January; online at < http://www.aas.org/cswa/status/status.jan99.final.pdf > (124 kB).

Sonnert, G. 1999b. "Women in science and engineering: Advances, challenges, and solutions," in *Women in Science and Engineering: Choices for Success* [Selby (1999)], pp. 34–57, 869.

Sonnert, G. & Holton, G. 1995. *Gender Differences in Science Careers: The Project Access Study*. Rutgers University Press. Amazon.com information at < http://tinyurl.com/2djvwu >.

Sonnert, G., & G. Holton. 1995. *Who Succeeds in Science?: The Gender Dimension*. Rutgers University Press. Amazon.com information at < http://tinyurl.com/2twvp8/ >. Note the "Search Inside" feature. For a review by the AWM's (2008) Marge Murry see < http://www.awm-math.org/bookreviews/JanFeb97.html >.

Sonnert, G. & G. Holton. 1996. "Career patterns of women and men in the sciences," *American Scientist* **84**: 63-71.

Sonnert, G., M.F. Fox, & K. Adkins. 2007. "Undergraduate Women in Science and Engineering: Effects of Faculty, Fields, and Institutions Over Time." *Social Science Quarterly* **88**(5): 1333-1356. Abstract online at
< http://www.blackwell-synergy.com/doi/abs/10.1111/j.1540-6237.2007.00505.x > :

OBJECTIVE: Taking an institutional approach to the determinants of outcomes for women in science and engineering, we examine the effects on women's percentages among undergraduate majors and among degree recipients of four basic factors: (1) the percentage of faculty who are women in the students' major science/engineering area; (2) the students' disciplines (biology, physical sciences, and engineering); (3) the type of institution in which students are enrolled ("Research I" vs. others); and (4) a time trend (1984–2000).

METHOD: We use longitudinal, multivariate, and multi-institutional data from the Integrated Postsecondary Data System (IPEDS) and from a mail survey of registrars.

RESULTS: Over the observation period, the women's percentages have risen steadily. The effects of disciplines and departments are stronger than those of institutions. Especially notable is that the percentages of women among undergraduate science/engineering majors and degree recipients are associated with the percentages of women among the faculty in these fields.

CONCLUSION: The findings contribute empirically to the discussion about the effects of "role models" for the participation and performance of women in science and engineering—and point to the strong effects of departments, compared to institutions, in accounting for degrees awarded to undergraduate women.

#SV Sorby, S.A., F. Wysocki, B.J. Baartmans. 2002. *Introduction to 3D Spatial Visualization: An Active Approach*. ENGAGE Delmar Learning. Amazon.com information at
< http://tinyurl.com/3cv9ea >. Note the "Search Inside" feature.

On average, males usually score about two standard deviations above females on spatial visualization tests. This difference is often attributed to cultural factors. Supporting this assumption, Sorby *et al*. showed that women engineers at Michigan Technological University could perform as well as men on spatial visualization tests if brought up to speed by a one-quarter (6 hr/week) visualization course based on this text.

#SSG Spears, J.D. 2008. "Seeing Gender" *Phys. Teach.* **46**(3): 136-137, online to subscribers at < http://scitation.aip.org/dbt/dbt.jsp?KEY=PHTEAH&Volume=46&Issue=3 >. Spears wrote:

"Most educators see gender bias in schools as a thing of the past. Yet women's participation in science, technology, engineering, and mathematics (STEM) fields continues to lag behind men. Women have made more progress in law and medicine than in physics.

To be sure, the blatant barriers that I and other women experienced as undergraduate physics majors in the 1960s are gone—they are unthinkable in today's schools and universities. What remains is a layer of subtle barriers. . . . . .

'Seeing Gender: Tools for Change' is an interactive CD-ROM that introduces the research on how males and females experience education differently. Developed with funding from the National Science Foundation (Grant # 0225184), the project grew out of work with middle and high school mathematics and science teachers as part of a graduate level course.

An opening module, 'Gender Schemas,' presents the larger framework from which to understand the more subtle biases that operate in STEM classrooms. Three modules, 'Teachers,' 'Girls,' and 'Boys,' explore how gender schema contributes to classroom interactions that discourage girls. The concluding module, 'Undoing Accumulated Disadvantage,' introduces a series of strategies for making STEM classrooms more equitable. A companion CD provides templates for professional development workshops ranging in duration from a couple of hours to a complete day as well as supplementary materials.

'Seeing Gender' is available at no cost through the Midwest Equity Assistance Center at Kansas State University. The material included in both CDs is available at < http://www.meac.org >. A link is provided at the bottom of the homepage. Individuals can download the files and burn their own CDs for either individual or group use."

#SDMA Spelke, E.S. 2005. "Sex differences in intrinsic aptitude for mathematics and science?: A critical review." *American Psychologist* **60**(9): 950-958; online at < http://www.wjh.harvard.edu/~lds/pdfs/spelke2005.pdf > (176 kB). The abstract reads:

"This article considers 3 claims that cognitive sex differences account for the differential representation of men and women in high-level careers in mathematics and science: (a) males are more focused on objects from the beginning of life and therefore are predisposed to better learning about mechanical systems; (b) males have a profile of spatial and numerical abilities producing greater aptitude for mathematics; and (c) males are more variable in their cognitive abilities and therefore predominate at the upper reaches of mathematical talent. Research on cognitive development in human infants, preschool children, and students at all levels fails to support these claims. Instead, it provides evidence that mathematical and scientific reasoning develop from a set of biologically based cognitive capacities that males and females share. These capacities lead men and women to develop equal talent for mathematics and science."

Elizabeth Spelke < http://www.wjh.harvard.edu/~lds/index.html?spelke.html > is a Harvard cognitive psychologist. She maintains a "Sex & Science" webpage < http://www.wjh.harvard.edu/~lds/sexsci/ >, has been profiled in the New Yorker < http://www.newamerica.net/publications/articles/2006/the_baby_lab >, and appears in the Wikipedia at < http://en.wikipedia.org/wiki/Elizabeth_Spelke >. For her debate with Steven Pinker see Pinker & Spelke (2005).

#SDMA Spelke, E.S. & A.D. Grace. 2006. "Sex, Math, and Science," in Ceci & Williams (2006). See also Pinker & Spelke (2005): "The Science Of Gender And Science - Pinker vs. Spelke - A Debate."

#LPE *Speth, J.G. 2008. *The Bridge at the Edge of the World: Capitalism, the Environment, and Crossing from Crisis to Sustainability*. Yale University Press, publisher's information at < http://yalepress.yale.edu/yupbooks/book.asp?isbn=978030013611 >:

"How serious are the threats to our environment? Here is one measure of the problem: if we continue to do exactly what we are doing, with *no* growth in the human population or the world economy, the world in the latter part of this century will be unfit to live in. Of course human activities are not holding at current levels—they are accelerating, dramatically—and so, too, is the pace of climate disruption, biotic impoverishment, and toxification. In this book Gus Speth, author of *Red Sky at Morning* and a widely respected environmentalist, begins with the observation that the environmental community has grown in strength and sophistication, but the environment has continued to decline, to the point that we are now at the edge of catastrophe.

Speth contends that this situation is a severe indictment of the economic and political system we call modern capitalism. Our vital task is now to change the operating instructions for today's destructive world economy before it is too late. The book is about how to do that."

See also Speth's website < http://www.thebridgeattheedgeoftheworld.com/ >:

"My point of departure in this book is the momentous environmental challenge we face. But today's environmental reality is linked powerfully with other realities, including growing social inequality and neglect and the erosion of democratic governance and popular control… As citizens we must now mobilize our spiritual and political resources for transformative change on all three fronts." – Gus Speth

"When a figure as eminent and mainstream as Gus Speth issues a warning this strong and profound, the world should take real notice. This is an eloquent, accurate, and no-holds-barred brief for change large enough to matter." – Bill McKibben

Amazon.com information at < http://tinyurl.com/5v6m4w > - includes many editorial reviews.

Spertus. E. 1991."Why Are There So Few Female Computer Scientists" MIT Artificial Intelligence Laboratory Technical Report 1315; online at < http://people.mills.edu/spertus/Gender/pap/womcs.txt >.

Spertus. E. 1997. Guest Editorial, "Women and Minorities in Science and Engineering," listing of references, online at < http://people.mills.edu/spertus/Gender/wom_and_min.html >.

Spitzberg, I.J, Jr. & V.V. Thorndike, 1992. *Creating Community On College Campuses,* State University of New York Press; publisher's information at < http://www.sunypress.edu/details.asp?id=52477 >.

Springs, S.L. & M. Braff. 2007. "The NSF ADVANCE Program: Promoting Women in Academic Science and Engineering," *AWIS Magazine*, Spring, online at < http://www.awis.org/pubs/documents/AWISmagSpring2007.pdf > (2.8 MB):

> "The number of women awarded doctoral degrees in science and engineering has increased from 14% to 37% over the last 30 years (1). However, the representation of women in corresponding academic faculty positions has lagged behind, especially in the most senior positions. For example, as of 2003, 25% of Ph.D. degrees in the physical sciences were awarded to women, while only 6% of full professorships in these fields were held by women (2). To address the complex issues behind this problem, the National Science Foundation (NSF) launched the ADVANCE program in 2001 (3). The mission of this program is to increase the number, advancement, and leadership of women faculty in science, engineering, and mathematics (SEM) departments. The NSF hopes that these initiatives will increase diversity and create the broadest talent pool possible to support national science and engineering interests. We took a closer look at the NSF's efforts by focusing on three ADVANCE programs for institutional transformation."

*Springer, L., M.E. Stanne, and S.D. Donovan. 1999. "Undergraduates in science, mathematics, engineering, and technology: a meta-analysis." *Review of Educational Research* **69**(1): 21-51. online at < http://rer.sagepub.com/cgi/reprint/69/1/21 >.

#EB *Squire, L.R. & E.R. Kandel. 2000. *Memory: From Mind to Molecules*. W.H. Freeman. Amazon.com information at < http://tinyurl.com/5yoxes >. A Google "book preview" is online at < http://tinyurl.com/3q3qug >. See also Kandel (2006).

#SDMA Stage, E.K. & R. Karplus. 1981. "Mathematical Ability: Is Sex a Factor?" *Science* **212**: 114; online to subscribers at < http://www.sciencemag.org/cgi/reprint/212/4491/118-a >.

#SDMA Stanley, J.C. 1997. "Amazing academic achievement, "*Johns Hopkins Magazine* **49**(4): 6, September; online at < http://www.jhu.edu/~jhumag/0997web/letters.html >. Stanley wrote:

> "The facts are as follows: in 1981 there were 28 boys and no girls who in SMPY's annual search scored 700 or more on SAT-M before age 13. That was a low year, however. In 1980 there had been 15 boys and 5 girls. The usual male-to-female ratio at that score level nowadays is about 4 to 1. During the early 1980s it was 12 to 1, so girls appear to be doing increasingly better compared with boys -- but have not nearly caught up with them yet."

*Steadman, L.C. 1996. "The Achievement Crisis is Real: A Review of *The Manufactured Crisis*," in *Education Policy Analysis Archives* **4**(1): 23 January; online at < http://epaa.asu.edu/epaa/v4n1.html >.

See *The Manufactured Crisis* [Berliner & Biddle (1996).

*Steen, L.A. 2003. "Math Education at Risk," *Issues in Science and Technology*, Summer, online at < http://www.issues.org/19.4/steen.html >. Steen wrote (our *italics*):

"By 1990, the president and the state governors formally adopted six national goals for education, including this one: 'By the year 2000, United States students will be the first in the world in mathematics and science achievement.' Subsequently, states established standards in core academic subjects and introduced tests aligned with these standards to measure the performance of students, teachers, and schools.

Yet today, the nation remains very much at risk in this area. Although newsmaking perils appear more immediate (viruses, terrorists, deficits, unemployment), *underachievement in education remains the most certain long-term national threat*. Despite brave rhetoric and countless projects, we have not vanquished educational mediocrity, especially not in mathematics and science. Judging by recent policy proposals, we have not even grasped the true character of the problem.

a. Student performance has stagnated. The average mathematics performance of 17-year-olds on the National Assessment of Educational Progress (NAEP) is essentially the same now as it was in 1973. . .

b. Mathematics performance remains substandard. In 2000, only one in six 12th-grade students achieved the NAEP "proficient" level, and only 1 in 50 performed at the 'advanced' level. . . .

c. The gap between low- and high-performing students is immense. In mathematics, the difference between the highest and lowest NAEP quartiles for 17-year-olds is approximately the same as the difference between the average scores for 17- and 9-year-olds--roughly equivalent to eight years of schooling.

d. Racial and ethnic gaps are persistent and large. In 2000, one in three Asian/Pacific Islanders in the 12th grade and one in five white 12th graders scored at the NAEP's proficient level, but less than 1 in 25 Hispanic and black 12th graders scored at that level. . . . .

e. Students in poverty perform poorly. Twelfth-grade students who are eligible for the national school lunch program perform on the NAEP at about the same level as 8th-grade students who are not in the school lunch program. . . . .

One important exception to this recital of failure is gender equity. After decades of under representation, girls are now as likely as boys to take advanced mathematics classes and more likely to take biology and chemistry. They remain, however, less likely to take physics. More important, the differences in performance between boys and girls on most high-school mathematics and science examinations are no longer statistically significant."

Lynn Arthur Steen < http://www.stolaf.edu/people/steen/ > is professor of mathematics at St. Olaf College in Northfield, Minnesota. He is a past president of the Mathematics Association of America (MAA) and has served as chairman of the Conference Board of the Mathematical Sciences.

Stewart, G. & J. Osborn. 1998. "Closing the Gender Gap in Student Confidence: Results from a University of Arkansas Physics Class," *Journal of Women and Minorities in Science and Engineering* **4**(1).

#CE *Steffe, L., & J. Gale, eds. 1995. *Constructivism in Education*. Lawrence Erlbaum. Amazon.com information at < http://tinyurl.com/33gph7 >; a "book preview" is online at < http://tinyurl.com/2p48wx >.

According to the preface the core paradigms discussed in this book are "social construct*ivism*, radical construct*ivism*, social construct*ionism*, information processing construct*ivism*, cybernetic systems, and sociocultural approaches to mediated action." [Our *italics*.]

*Stein, S. 1997. "Preparation of Future Teachers," *Notices of the AMS* **44** (3): 311-312; online at < http://www.ams.org/notices/199703/letters.pdf > (108 kB). Stein, writing of mathematics education, but his comments apply as well to other branches of education (our *italics*):

"The first stage in the reform movement should have been to improve the mathematical knowledge of present and prospective elementary teachers. Unfortunately, the cart of curriculum reform has been put before the horse of well-prepared teachers. . . . . If all teachers were mathematically well prepared, I for one would stop worrying about the age-old battle still raging between 'back to basics' and 'understanding.' *On the other hand, if mathematics departments do nothing to improve school mathematics, they should stop complaining that incoming freshmen lack mathematical skills*."

*Stokes, D.E. 1997. *Pasteur's quadrant: Basic science and technological innovation*. Brookings Institution Press, publisher's information at < http://www.brookings.edu/press/Books/1997/pasteur.aspx >. Amazon.com information at < http://tinyurl.com/4b7h63 >.

*Stokstad, E. 2001. "Reintroducing the Intro Course," *Science* **293**: 1608-1610, 31 August; online at < http://tinyurl.com/266973 >.

Stokstad wrote: "Physicists are out in front in measuring how well students learn the basics, as science educators incorporate hands-on activities in hopes of making the introductory course a beginning rather than a finale."

#SSIGD #SDMA Summers, L.H. 2005. "Remarks at NBER Conference on Diversifying the Science & Engineering Workforce" [NBER = National Bureau of Economic Research] < http://www.nber.org/ >], transcript online at < http://www.president.harvard.edu/speeches/2005/nber.html >. Summers said [our *italics*]:

"There are three broad hypotheses about the sources of the very substantial disparities that this conference's papers document and have been documented before with respect to the presence of women in high-end scientific professions. . . . . .the first is what I call the *high-powered job hypothesis*. The second is what I would call ***different availability of aptitude at the high end***, and the third is what I would call *different socialization and patterns of discrimination in a search*. And in my own view, their importance probably ranks in exactly the order that I just described."

The second hypothesis *"different availability of aptitude at the high end"* drew the attention of academics, created a firestorm in the media, resulted in Summers' resignation, and is encapsulated in the following provocative excerpt from the transcript:

". . . . why is the representation [of women] even lower and more problematic in science and engineering than it is in other fields. And here, you can get a fair distance, it seems to me, looking at a relatively simple hypothesis. It does appear that on many, many different human attributes - height, weight, propensity for criminality, overall IQ, mathematical ability, scientific ability - there is relatively clear evidence that whatever the difference in means - which can be debated - *there is a difference in the standard deviation, and variability of a male and a female population. And that is true with respect to attributes that are and are not plausibly, culturally determined*. [Our *italics*.] If one supposes, as I think is reasonable, that if one is talking about physicists at a top twenty-five research university, one is not talking about people who are two standard deviations above the mean. And perhaps it's not even talking about somebody who is three standard deviations above the mean. But it's talking about people who are three and a half, four standard deviations above the mean in the one in 5,000, one in 10,000 class. Even small differences in the standard deviation will translate into very large differences in the available pool . . . .[our insert - the transcript has "substantially out" at this point and is probably garbled – Summers probably meant something like "at the high-end tail of the distribution"].

Our thanks to Moira McDermott for this reference, given on her site < http://www.gustavus.edu/~mmcdermo/women-science-links.html > as "Transcript of Summers' remarks."

*Sunal, D.W., E.L. Wright, & J.B. Bay, eds. 2004. *Reform in Undergraduate Science Teaching for the 21st Century*. Information Age Publishing. Amazon.com information at < http://tinyurl.com/5ppq96 >. Note the "Search Inside" feature.

#CE *Taber, K.S. 2006. "Constructivism's New Clothes: The Trivial, the Contingent, and a Progressive Research Programme into the Learning of Science," *Foundations of Chemistry* **8**(2): 1572-8463; in a special issue "Constructivism in Chemical Education," online to subscribers at < http://tinyurl.com/2nd9cc >. An abstract of Tabor's article is online at < http://tinyurl.com/2kcmye >.

Taber, K.S. 2007. Review of Geary (2007) in *Education Review: A Journal of Book Reviews*; online at < http://edrev.asu.edu/reviews/rev611.htm >.

Thom, M. 2001. *Balancing the Equation: Where are Women and Girls in Science, Engineering, and Technology?* National Council for Research on Women; Amazon.com information at < http://tinyurl.com/37jy4t >. Note the "Search Inside" feature.

#IE *Thorn, P. 2008. "Summary of responses to locate science education reform references?" POD post of 20 Jun 2008 11:28:25 -0700; online at < http://tinyurl.com/4a4m9b > .

*Thornburg, D. 2008. "Mathematics and Policy," *The Pulse* (District Administrator Blog), 17 March; online at < http://tinyurl.com/3sj598 >. Thornburg wrote [our insert at ". . . . [insert]. . . ."; our *italics*]:

> Recent pronouncements from Washington regarding math education have suggested that pedagogical points of view don't matter in the teaching of mathematics. For example: "There is no basis in research for favoring teacher-based or student-centered instruction," Dr. Larry R. Faulkner, the chairman of the panel, said at a briefing last Wednesday. "People may retain their strongly held philosophical inclinations, but the research does not show that either is better than the other."
>
> Well, actually, Larry, if you read. . . .[*Rising Above the Gathering Storm* [NAP (2007b)]. . . . you will likely be shocked to learn that, in fact, there are two methodologies proven to improve math proficiency: Statewide specialty high schools (e.g., IMSA) and *inquiry-driven project-based learning (e.g., constructionism.)* Now it may well be that Dr. Faulkner has more reliable sources than those at the National Academy of Science and other groups that contributed to this 591 page report on the challenge faced by the US in the areas of science and math education. However, let's assume for the moment that the National Academies tend to use fairly reliable folks to generate their reports. In this case, then Faulkner is simply flat out wrong. There IS research showing that one methodology is better than another, and I just cited it. The fact that this research was reported by the same government that claims it does not exist is a puzzlement at best, and an example of the "big lie" at worst. Faulkner's strategy seems to be that, if you lie to the American public loudly enough, it will believe you. Kind of like finding WMD in Iraq.
>
> > Regarding favorable discussion of inquiry-based learning in *Rising Above the Gathering Storm* , a search at < http://books.nap.edu/catalog.php?record_id=11463 > for "inquiry" yields 15 hits. For example on pages 97-98 it is stated:
> >
> > > ". . . .an examination of curricula reveals that middle school mathematics and science courses lack focus, cover too many topics, repeat material, and are implemented inconsistently. That could be changing, at least in part because of new science and mathematics teaching and learning standards that emphasize inquiry and detailed study of fewer topics."

*Tobias, S. & R.R. Hake. 1988. "Professors as physics students: What can they teach us?" *Am. J. Phys.* **56**(9): 786-794; online at < http://www.physics.indiana.edu/~hake/ProfsAsStudents.pdf > (1.1 MB).

Tobias, Sheila. 2008. Website at < http://www.sheilatobias.com/ >.

*Tobias, S. 1990. *They're Not Dumb, They're Different: Stalking the Second Tier*. Research Corporation. For a description of this and other books by Tobias see < http://www.sheilatobias.com/talks.html >. On page 14, Tobias writes (our *italics*.):

> The second tier is a loose hypothetical construct, which includes a *variety* of types of students not pursuing science in college for a *variety* of reasons . . . *The study began with at least one assumption: the second tier is not the second rate*. So in search of second tier stand-ins we looked for high-achievers (in their respective fields) who were serious about their learning and career goals." That Tobias's second-tier students were *not* second rate is consistent with the history of one of them, the late Eric Schocket who became an Associate Professor of American literature at Hampshire College – see < http://en.wikipedia.org/wiki/Eric_Schocket >.
>
> In our opinion the problem is not that traditional "chalk-and-talk" science instruction is ineffective for first-rate students in the so-called "second-tier," but rather that it is ineffective for almost ALL students – see e.g., Hake (1998a,b).

*Tobias, S. 1992. *Revitalizing Undergraduate Science: Why Some Things Work and Most Don't*. Research Corporation. For a description see < http://www.sheilatobias.com/talks.html >.

Tobias, S. 1994. *Overcoming Math Anxiety*, Norton. For a description see < http://www.sheilatobias.com/talks.html >.

*Tobias, S. and C.T. Tomizuka. 1992. *Breaking the Science Barrier*. College Entrance Examination Board. A description is at < http://www.sheilatobias.com/talks.html >.

Tobias, S. 1995. "The 'Problem' of Women in Science: Why Is It So Difficult to Convince People There Is One?" online at < http://www.stsci.edu/stsci/meetings/WiA/tobias.pdf > (112 kB). In *A Hand Up: Women Mentoring Women in Science* (2nd Edition) [Fort (2005)].

Tobias, S., D.E. Chubin, & K. Aylesworth. 1995. *Rethinking Science as a Career*. Research Corporation. *See the index for material on "gender differences" and "gender issues."* A description is at < http://www.sheilatobias.com/talks.html >.

*Tobias, S. & J. Raphale. 1997. *The Hidden Curriculum: Faculty-Made Tests in Science*. Plenum Press. A description is at < http://www.sheilatobias.com/talks.html >.

*Tobias, S. 1997. "Some Recent Developments in Teacher Education in Mathematics and Science A Review and Commentary." online at < http://www.wcer.wisc.edu/archive/nise/Publications/Occasional_Papers/vol4.pdf > (5.3 MB)

Tobias, S. 1998. *Faces of Feminism: An Activist's Reflections on the Women's Movement*. Foundations of Social Inquiry, Westview Press. Amazon.com information at < http://tinyurl.com/55cep3 >. Note the "Search Inside" feature. A description is also at < http://www.sheilatobias.com/talks.html >.

Tobias, S. 2002. "Women & Physics, Physics & Women: A Puzzlement," in S.P. Marshall, J.A. Scheppler, & M.J. Palmisano, eds., *Science Literacy for the Twenty-first Century*. Prometheus Books, pp. 31-43. Amazon.com information at < http://tinyurl.com/6y3m4c >. Contributors include: Stephen J. Gould, Howard Gardner, Margaret Geller, James Trefil, Lawrence Krauss, George Keyworth, and Bruce Alberts:

> Related to some women's lack of confidence is the terrible sense imparted to some young women in high school, that they have to choose "either to be a girl or to do physics." This is in large measure because physics remains an 'elective' in U.S. high schools, intended only for "nerds."

#FSC Tobias, S., M. Urry, & A. Venkatesan. 2002. "Physics: For Women, the Last Frontier, editorial, *Science* **296**: 5571; online at < http://www.sciencemag.org/cgi/content/summary/296/5571/1201 >. Report on the International Union of Pure and Applied Physics (IUPAP)-sponsored international conference on women in physics held 7 to 9 March 2002 in Paris < http://www.if.ufrgs.br/~barbosa/conference.html >. Tobias *et al*. report [our *italics*]:

> *Neither the speakers in the formal sessions nor the delegates entertained the postmodernist position that without women, science must be biased*. Rather, the distinction was drawn between the conduct of science and the behavior of scientists, in this case physicists. To be sure, women need to better understand the mechanisms of hiring, funding, and promotion; that is, how to play the game. But the game itself has to be purged of cloning, patronage, and outright discrimination if transparency in hiring and promotion is to become the rule. 'Excellent men have nothing to fear from transparency,' concluded a French delegate.
>
> [See also the reports in *Physics Today* by Feder (2002) and in *APS News* (2002a).

Todaro, R.M. 2002. "Problems of Women and Minorities Receive Special Attention," *APS News,* April; online at < http://www.aps.org/publications/apsnews/200204/committees.cfm > :

> "Among the various committees of the American Physical Society, there are two dedicated to increasing the participation of those groups who have traditionally been vastly under-represented in physics, namely, women and minorities. The Committee on the Status of Women in Physics is devoted to the twin goals of improving the climate for women who are in physics and improving the academic pipeline through which women enter physics. The Committee on Minorities works on increasing the number of minorities in physics. Minorities include African Americans, Hispanics, and Native Americans, three groups who historically have each accounted for less than one percent of the total population of physics."

*Tomsho, R. 2006. "What's the Right Formula? Pressure From New Tests Leads Educators to Debate How Best to Teach Science" *Wall Street Journal*, 19 January; online for educators at < http://tinyurl.com/6zycrg > (scroll to the APPENDIX).

Toren, T. 2000. *Hurdles in The Halls of Science: The Israeli Case*. Lexington Books, publisher's information at < http://tinyurl.com/6cs8jn >. A Google "book preview" is online at < http://tinyurl.com/3zxnwk >. [See Reis (2000) for an excerpt.]

Traweek, S. 1992. *Beamtimes and Lifetimes: The World of High Energy Physicists*. Harvard University Press, publisher's information at < http://www.hup.harvard.edu/catalog/TRABEA.html >. For a review see Hufnagel (2006).

#DM #SSG Trie, L. 2006. "Biases must be tackled to achieve gender equity in mathematics, scholars argue." *Stanford Report*, 15 February; online at < http://news-service.stanford.edu/news/2006/february15/mathem-021506.html >. Trie wrote (our *italics*):

A year after Harvard President Lawrence Summers' remarks suggesting innate gender differences in science and math ability, the Institute for Research on Women and Gender (IRWG) on Feb. 7 hosted an event titled "Proof and Prejudice: Women in Mathematics," to examine the culture of mathematics in this country and women's experience as professional mathematicians. . . . . Despite advances, unexamined biases remain within the culture of mathematics and science, Schiebinger said. "Many are held unconsciously by men and also by women—in university math departments as well as in our society in general," she added. . . . . *Margot Gerritsen, a Stanford assistant professor of petroleum engineering who teaches mathematics, said there are no differences in ability between her male and female students*. "There are big differences … in attitude and perception," she said. "I've seen much higher stress levels in women starting academic careers—about how they can contribute and fit in—than with the men." Male students are more likely to shrug off temporary setbacks, such as a poor test result, than women, she said. . . . Stanford Associate Professor of Education Jo Boaler . . . . . [our insert – now at Sussex University in England as the Marie Curie professor in Education]. . . . ., an expert in mathematics education who spoke as a member of the audience, said elementary school teachers should not be blamed. *Girls and boys achieve at similar levels in mathematics through school and at the undergraduate level, she said. "Girls are still achieving at very high levels across the board—that's the message that should go out there,"* she said. "The idea that they're not is damaging in its own right." But after college, she said, the numbers drop off. According to Schiebinger, women earn 46 percent of undergraduate math degrees in this country but represent only 8 percent of math professors.. . . [our insert – Schiebinger may have meant "math *full* professors" – see Hale (2006)]. . . . . Mathematics has a public relations problem in this country, particularly among some girls and women, according to Hollywood actress Danica McKellar. "Nobody out there is saying that smart is sexy and smart is important," said McKellar, the co-author of a mathematical proof. "Role models like Paris Hilton have everything to do with why this country is being dumbed down. We need better PR.". . . . . *Even women who make it as mathematicians often feel excluded from the broader culture*, said Claudia Henrion. . . .[(1997)]. . . , author of *Women in Mathematics: The Addition of Difference*. In researching the book, a recurring theme arose, she said: "The women were very accomplished but they still felt as outsiders in the math community." The talent exists, Henrion said, so the question must be, "How do we cultivate it and how do we create communities in which it is maximized?"

Trie's report is featured in Rick Reis's (2006) "Proof and Prejudice: Women in Mathematics," and in the discussion list post by Hake (2006a).

Trower, C.A. 2001. "Women Without Tenure, Part I: The Gender Sieve" *Science*, 14 September; online at < http://tinyurl.com/4c8mlt > :

"National data show that women currently represent 41% (36% of fulltime and 45% of part-time) of the nearly 1 million faculty in the U.S., double the number from 1972. However, women represent only 25% of the fulltime faculty at research universities, a percentage that has barely budged from the 1972 figure of 18%. In 4-year colleges and universities, women SET (science, engineering, and technology) faculty hold fewer high-ranking posts than men, are less likely to be full professors, and are more likely to be assistant professors. . . . . 'Academic institutions, especially the SET departments, continue to be a male milieu in which men share traditions and women are more likely to be outsiders,' says the Land of Plenty report. . . . . [see CAWMSET (2000) and NSF (2005a)]. . . . 'Women scientists in a national survey report significantly fewer interactions with faculty, fewer resources, and heavier teaching loads than their male colleagues. Women are also less likely to form a mentoring relationship with a more senior faculty member.' "

Trower, C.A. 2002a. "Women Without Tenure, Part II: The Gender Sieve" *Science*, January, online at < http://tinyurl.com/4ez6g6 >.

Trower, C.A. 2002b. "Women Without Tenure, Part III: Why They Leave," *Science*, March; online at < http://tinyurl.com/58vtda >.

Tretkoff, E. 2004. "Small Inequalities Can Influence Women's Careers," *APS News*, July; online at < http://www.aps.org/publications/apsnews/200407/women-careers.cfm >.

Tretkoff, E. 2005a. "AIP Report: Women, Men Progress at Same Rate," *APS News*, April; online at < http://www.aps.org/publications/apsnews/200504/progress.cfm >. For the report see Ivie & Ray (2005).

#SSIGD Tretkoff, E. 2005b. "CSWP Responds to Harvard University President's Comments," APS News, March; online at < http://www.aps.org/publications/apsnews/200503/cswp.cfm >.

#FSP Tuana, N. 1989. *Feminism and Science*. Indiana University Press, publisher's information at < http://www.iupress.indiana.edu/catalog/product_info.php?products_id=21618 > :

> "Questioning the objectivity of scientific inquiry, this volume addresses the scope of gender bias in science. The contributors examine the ways in which science is affected by and reinforces sexist biases. The essays reveal science to be a cultural institution, structured by the political, social, and economic values of the culture within which it is practiced."

Tyack, D.B. & E. Hansot. 1992. *Learning Together: A History of Coeducation in American Public Schools*. Russel Sage Foundation. Amazon.com information at < http://tinyurl.com/5e9gpr >. Note the "Search Inside" feature.

*Tyack, D. & L. Cuban. 1995. *Tinkering Toward Utopia: A Century of Public School Reform*. Harvard University Press, publisher's information at < http://www.hup.harvard.edu/catalog/TYATIN.html >. A Google "book preview" is online at < http://tinyurl.com/6guoso >.

Udo, M.K. , G.P. Ramsey, S. Reynolds-Alpert, and J.V. Mallow. 2001. "Does Physics Teaching Affect Gender-based Science Anxiety?" *Journal of Science Education and Technology* **10**(3): 237-247; abstract online at < http://www.springerlink.com/content/p811455562205342/ >.

Udo, M.K. , G.P. Ramsey, and J.V. Mallow. 2004. "Science Anxiety and Gender in Students taking General Education Science Courses," *Journal of Science Education and Technology* **13**: 435-446; abstract online at < http://www.springerlink.com/content/t85v55814232u712/ >.

#LPE *Union of Concerned Scientists. 2008. Online at < http://www.ucsusa.org/ >. See especially "Global Warming" at < http://www.ucsusa.org/global_warming/science/ >:

"Global warming is already under way. The evidence is vast and the urgency of taking action becomes clearer with every new scientific study. Some of the most obvious signs are visible in the Arctic, where rising temperatures and melting ice are dramatically changing the region's unique landscapes and wildlife—as well as people's lives and livelihoods. Across the globe, other early warning signs include melting glaciers, shifting ranges of plants and animals, and the earlier onset of spring."

University of Michigan. 2008. "NSF Advance Project"; online at < http://sitemaker.umich.edu/advance/home > :

"The ADVANCE Program began as a five-year, grant-funded project promoting institutional transformation with respect to women faculty in science and engineering fields. With the University's commitment to continue funding through June 2011, the program is gradually expanding to promote other kinds of diversity among faculty and students in all fields."

University of Texas at Austin. 2008. Center for Women's and Gender Studies, online at < http://www.utexas.edu/cola/centers/cwgs/?path[0]=cwgs >.

University of Toronto. 2002. Women in Physics Web Page; online at < http://www.physics.utoronto.ca/wiphys/wiphys.html >; many good links, especially at

a. "Women in Physics Web Pages" < http://www.physics.utoronto.ca/wiphys/globalphys.html >,
b. "Women in Science Web Pages" < http://www.physics.utoronto.ca/wiphys/globalsci.html >.
For more recent (2007) information see at
< http://www.astro.utoronto.ca/AALibrary/old/womenbib.html >.

University of Wisconsin. 2008. Women and Science Program.; online at < http://www.uwosh.edu/programs/wis/ >; see links to

a. "Library Resources - Books" at < http://www.uwosh.edu/programs/wis/books.php > ;
b. "History and Statistics" < http://www.uwosh.edu/programs/wis/history-stats.php >.

#AA Urry, M. 1999. "The Baltimore Charter and the Status of Women in Astronomy," *STATUS,* June; online at < http://www.aas.org/cswa/status/status_june99.pdf > (320 kB). Urry wrote:

"The purpose of the Baltimore Charter was to suggest concrete action (not just griping) to improve the status of women in astronomy. It represents the consensus of many views, with input from a significant fraction of the active astronomical community. . . . . It was released in June 1993 at the semi annual meeting of the American Astronomical Society, receiving a lot of attention from the national press and popular science publications. In subsequent months the Baltimore Charter and/or its goals were endorsed by the AAS, NASA, NSF, AURA, and several prominent universities. . . . . The Charter states five basic premises and briefly justifies them . . . A key assertion is that positive action is required to change the status quo, hence the five major recommendations of the Charter. *The most important of these, and the most controversial, is the statement that 'Affirmative action is a necessary part of the solution'*. . . . . The Charter ends with a call to action, to all our colleagues, to facilitate the full participation of women. . . . There was no mass movement to endorse the Baltimore Charter or to implement its recommendations widely, although it appears to have helped some individual women, especially those isolated in small departments."

Urry, M. 2000. "The Status of Women in Astronomy," *STATUS*, June; online at < http://www.aas.org/cswa/status/status_jun00.pdf > (200 kB).

#MIT Urry, M. 2001. "Criticism and Defense of the MIT Report," *STATUS*, June; online at < http://www.aas.org/cswa/status/status_jun01.pdf > (10 MB):

> "MIT's admission two years ago that it had unintentionally discriminated against women was unprecedented. . . . Then came the follow-up meeting at MIT, attended by university presidents, chancellors, provosts, and 25 women faculty, representing top research universities. They met January 29, 2001 to discuss equitable treatment of women faculty in science and engineering. The statement issued by the leaders of the nine universities . . .Cal Tech, MIT, Michigan, Princeton, Stanford, Yale, Berkeley, Harvard, Pennsylvania . . . recognized that barriers to women still exist and promised to work for full and equal participation by women faculty in their institutions."

Urry, M. 2005. "Diminished by Discrimination We Scarcely See," *Washington Post*, 6 February 2005, p. B4; online at < http://www.washingtonpost.com/wp-dyn/articles/A360-2005Feb5.html >. A shorter version of this essay appears in APS News, May 2005, online at < http://www.aps.org/publications/apsnews/200505/viewpoint.cfm >.

Urry, M. 2007. Affecting the Climate for Women in Physics: The CSWP Site Visit Program," STATUS, June, online at < http://www.aas.org/cswa/status/StatusJune07.pdf > (712 kB).

#DM *USA Today*. 2007. "Person of the Week: Danica McKellar: 'Wonder Years' Actress Takes a Break From Hollywood to Do Some Math," 10 August, World News with Charles Gibson; online at < http://abcnews.go.com/WN/PersonOfWeek/story?id=3467211&page=1 >.

*USDE. 2008. U.S. Dept. of Education, "National Mathematics Advisory Panel Releases Final Report," online at < http://www.ed.gov/about/bdscomm/list/mathpanel/index.html >. See also "Education Panel Lays Out Truce in Math Wars" [Hechinger (2008)]; "Report Urges Changes in Teaching Math" [Lewin (2008)]; "Mathematics and Policy" [Thornburg (2008)]; "U.S. Mathematics Education: Well-Balanced Panel to Tackle Algebra Reform" [Mervis (2006)]; and "Guest Editorial: Report of the National Mathematics Advisory Panel" [Greer (2008)]. According to the USDE:

> On March 13, 2008, the National Mathematics Advisory Panel presented its Final Report to the President of the United States and the Secretary of Education. Copies of these ground-breaking reports, rich with information for parents, teachers, policy makers, the research community, and others, are provided below.
>
> > Links to five Draft Task Group Reports and three Draft Subcommittee Reports are given. The complete report *Foundations for Success* is online at < http://www.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf > (852 kB). Members of the Advisory Panel are Larry R. Faulkner, Chair; Camilla Persson Benbow, Vice Chair; and Deborah Loewenberg Ball, A. Wade Boykin, Douglas H. Clements, Susan Embretson, Francis "Skip" Fennell, Bert Fristedt, David C. Geary, Russell M. Gersten, Tom Loveless, Liping Ma, Valerie F. Reyna, Wilfried Schmid, Robert S. Siegler, James H. Simons, Sandra Stotsky, Vern Williams, and Hung-Hsi Wu.
>
> The Executive Summary states:
>
> > The essence of the Panel's message is *to put first things first*. There are six elements, expressed compactly here, but in greater detail later.
> >
> > 1. The mathematics curriculum in Grades PreK–8 should be streamlined and should emphasize a well-defined set of the most critical topics in the early grades. *Students who complete Algebra II are more than twice as likely to graduate from college compared to students with less mathematical preparation.*
> >
> > 2. Use should be made of what is clearly known from rigorous research about how children learn, especially by recognizing
> >
> > a. the advantages for children in having a strong start;
> >
> > b. the mutually reinforcing benefits of conceptual understanding, procedural fluency, and automatic (i.e., quick and effortless) recall of facts; and
> >
> > c. that effort, not just inherent talent, counts in mathematical achievement.
> >
> > 3. Our citizens and their educational leadership should recognize mathematically knowledgeable classroom teachers as having a central role in mathematics education and should encourage rigorously evaluated initiatives for attracting and appropriately preparing prospective teachers, and for evaluating and retaining effective teachers.
> >
> > 4. Instructional practice should be informed by high-quality research, when available, and by the best professional judgment and experience of accomplished classroom teachers. High-quality research does not support the contention that instruction should be either entirely "student centered" or "teacher directed." Research indicates that some forms of particular instructional practices can have a positive impact under specified conditions.
> >
> > 5. NAEP and state assessments should be improved in quality and should carry increased emphasis on the most critical knowledge and skills leading to Algebra.
> >
> > 6. The nation must continue to build capacity for more rigorous research in education so that it can inform policy and practice more effectively.

#AA USGAO. 2004. United States Government Accountability Office, "GENDER ISSUES: Women's Participation in the Sciences Has Increased, but Agencies Need to Do More to Ensure Compliance with Title IX," July, online at < http://www.gao.gov/new.items/d04639.pdf > (4.9 MB).

Valian, V. 1999. *Why so Slow?* MIT Press. publisher's information at < http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=5581 > Amazon.com information at < http://tinyurl.com/363elx >. Note the "Search Inside" feature. A synopsis, evidently by Valian herself, appears at < http://maxweber.hunter.cuny.edu/psych/faculty/valian/valian.htm#synop > :

> "Why do so few women occupy positions of power and prestige? This book uses concepts and data from psychology, sociology, economics, and biology to explain the disparity in the professional advancement of men and women. The claim is that men and women alike have implicit hypotheses about gender differences - gender schemas - that create small sex differences in characteristics, behaviors, perceptions, and evaluations of men and women. Those small imbalances accumulate to advantage men and disadvantage women. The most important consequence of gender schemas for professional life is that men tend to be overrated and women underrated.
>
> Although most men and women in the professions sincerely hold egalitarian beliefs, those beliefs alone cannot guarantee impartial evaluation and treatment of others. Only by understanding how our perceptions are skewed by gender schemas can we begin to perceive ourselves and others accurately. The goal in *Why So Slow?* is to make the invisible factors that retard women's progress visible so that fair treatment of men and women will be possible. The book makes its case with experimental and observational data from laboratory and field studies of children and adults, and with statistical documentation on men and women in the professions. The many anecdotal examples throughout provide a lively counterpoint."

Valian, V. 1999. "Sex, Schemas, and Success: What's Keeping Women Back?" *STATUS*, January; online at < http://www.aas.org/cswa/status/status.jan99.final.pdf > (124 kB).

Valian, V. 2005. "Beyond gender schemas: Improving the advancement of women in academia." *Hypatia* **20**(3): 198-213; online as a 256kB pdf at < http://tinyurl.com/6yewcy >.

Valian, V. 2006. "Women at the Top in Science – and Elsewhere," in Ceci & Williams (2006); online as a 808 kB pdf at < http://tinyurl.com/634cqf >.

Valian, V. 2006. Homepage at Hunter College < http://maxweber.hunter.cuny.edu/psych/faculty/valian/valian.htm >.

#IC *Valverde, G.A. & W.H. Schmidt, 1997-98. "Refocusing U.S. Math and Science Education: International comparisons of schooling hold important lessons for improving student achievement" *Issues in Science and Technology Online*, Winter: < http://bob.nap.edu/issues/14.2/schmid.htm >.

#IC *Valverde, G.A., L.J. Bianchi, R.G. Wolfe, W.H. Schmidt, R.T. Houang. 2002. "*According to the Book: Using TIMSS to Investigate the Translation of Policy to Practice Through the World of Textbooks."* Kluwer. Amazon.com information at < http://tinyurl.com/bodpu >.

van der Veen, J. 2006. "Doing Physics, Performing Gender? A sociolinguistic approach towards understanding the persistent gender gap in physics," online at < http://www.physics.ucsb.edu/~jatila/papers/phys&gender_revised.pdf > (676 kB).

van der Veen, J. 2008. "Symmetry and Aesthetics in Introductory Physics: Bringing the sense of wonder back into physics education," presented at the Kavli Institute for Theoretical Physics. April; online at < http://www.physics.ucsb.edu/~jatila/papers/for_KITP_04-25-2008.pdf > (3.9 MB).

Jatila van der Veen describes an "aesthetic physics curriculum" that (a) *puts Emmy Noether before Isaac Newton* (see p. 11), (b) regards art as a way of looking at everything including math, (c) employs interdisciplinary strategies: literature, writing, discussing, drawing, composing, problem solving, and creative physics-art projects.

#EB *Varma, S, B.D. McCandliss, & D.L. Schwartz. 2008. "Scientific and Pragmatic Challenges for Bridging Education and Neuroscience," *Educational Researcher* **37**(3): 140–152; online to subscribers at < http://www.aera.net/publications/Default.aspx?menu_id=38&id=5238 > , The abstract reads:

"Educational neuroscience is an emerging effort to integrate neuroscience methods, particularly functional neuroimaging, with behavioral methods to address issues of learning and instruction. This article consolidates common concerns about connecting education and neuroscience. One set of concerns is *scientific:* in-principle differences in methods, data, theory, and philosophy. The other set of concerns is *pragmatic:* considerations of costs, timing, locus of control, and likely payoffs. The authors first articulate the concerns and then revisit them, reinterpreting them as potential opportunities. They also provide instances of neuroscience findings and methods that are relevant to education. The goal is to offer education researchers a window into contemporary neuroscience to prepare them to think more specifically about the prospects of educational neuroscience."

Vetter, B.M. 1996. "Myths and realities of women's progress in the sciences, mathematics and engineering," in *The Equity Equation: Fostering the Advancement of Women in the Sciences, Mathematics and Engineering* in [Davis *et al*. (1996)].

Vetter, B.M. 1981. "Women scientists and engineers: Trends in participation." *Science* **214**: 1313-1321; abstract online at < http://tinyurl.com/6qczyh >.

#SV Voyer, D., S. Voyer, & M.P. Bryden. 1995. "Magnitude of sex differences in spatial abilities: A meta-analysis and consideration of critical variables," *Psychological Bulletin* **117**: 250-270; abstract online at < http://tinyurl.com/5l5uoj >.

Wachs, F.L., J. Nemiro, & J. Whyte. 2007. "Speaking Out on Gender: Reflections on Women's Advancement in the STEM Disciplines," *J. Women and Minorities in Sci. and Eng*. **13** (1): 77-94; abstract online at < http://tinyurl.com/3ocrgu >.

WAGE. 2008. We Advocate Gender Equity < http://www.wage.org/about.html > :

"WAGE is a system wide organization whose official mission, is 'To end gender bias and achieve gender equity in the education, hiring, retention, promotion and compensation of women in the academic community within the University of California and other academic institutions.' While initially started around individuals at UCB and UCI who had tenure grievances and legal actions, WAGE has expanded to include all women and men whether or not affiliated with UC, committed to improving the status of UC academic women."

Walberg, H. J. 1969. "Physics, femininity, and creativity. " *Develop. Psych.* **1**: 47-54; abstract online at < http://content.apa.org/journals/dev/1/1/47.pdf > (76 kB).

Warden, A. 2005. "Time to Confront Political Asymmetry in Physics," APS News, April; online at < http://www.aps.org/publications/apsnews/200504/letters.cfm >. Warden wrote (with tongue in cheek): "My guess is that, percentage wise, Republicans are even more under-represented than women. The APS should do something about this. The APS has a very active Committee on the Status of Women in Physics (CSWP). It is time to establish a parallel CSRP, and to develop a pro-active strategy to recruit more Republicans." For a response see White (2005).

Wasserman, E. 2000. *The Door in the Dream: Conversations With Eminent Women in Science*. Joseph Henry Press, an imprint of the National Academies Press. Publishers information at < http://www.nap.edu/catalog/6375.html >.

Among those interviewed are Mary Ellen Avery, May R. Berenbaum, Mary K. Gaillard, Margaret Kidwell, Judith P. Klinman, Nancy Kopell, Marian Koshland, Jane Lubchenco, Pamela Matson, Cathleen Morawetz, Myriam Sarachik, Joan Steitz, and Susan Taylor [preface by R.R. Colwell (2000)].

Watt, H.M.G. & J.S. Eccles. 2008. *Gender and Occupational Outcomes: Longitudinal Assessment of Individual, Social, and Cultural Influences.* American Psychological Association, publisher's information at < http://books.apa.org/books.cfm?id=4316102 > :

Despite concentrated research and important legislative milestones on gender equality over the past quarter-century, gender-related disparities in science, technology, and math careers persist into the 21st century. This persistence sustains a troubling state of gender inequity in which women are not sharing in the salary and status advantages attached to scientific and technical careers. In this landmark volume, editors Watt and Eccles, both well known for their research contributions in this area, compile a rich source of longitudinal analysis that places the problem in context.

*WCER. 2008. Wisconsin Center for Education Research, online at < http://www.wcer.wisc.edu/about.php > :

Under the direction of Adam Gamoran, the Wisconsin Center for Education Research is one of the oldest, largest, and most productive education research centers in the world. A part of the University of Wisconsin–Madison's School of Education, WCER provides a productive environment where some of the country's leading scholars conduct basic and applied education research. The WCER roster includes research centers and projects that are currently investigating a variety of topics in education.

#SSB Weaver-Hightower, M. B. 2003. "The 'boy turn' in research on gender and education, " *Review of Educational Research* **73**(4): 471–498, online to subscribers at < http://rer.sagepub.com/cgi/reprint/73/4/471>.

#SSG #SSB Weaver-Hightower, M.B. 2008. "An Ecology Metaphor for Educational Policy Analysis: A Call for Complexity," *Educational Researcher* **37**(3): 153-167; online at < http://www.aera.net/publications/Default.aspx?menu_id=38&id=5238 >. The abstract reads:

"Educational policy might productively be conceptualized with an ecology metaphor. Each policy, thus considered, exists within a complex system that reflects varied international, national, regional, and local dynamics. Using this metaphor provides policy analysts with a view of the regularities and irregularities of any policy, its process, its texts, its reception, and its degree of implementation. The characteristics of policy ecologies alert analysts to the possibilities of great transformation, for good or ill, and give them a way to conceptualize how such transformations occur. Perhaps most important, using an ecology metaphor suggests specific ways that progressive researchers might positively intervene in the policy process."

Weaver Hightower wrote (*italics* in the original):

"Scholarship on girls' education has continued, but the pressure for girls' issues peaked in the early 1990s, particularly after high-profile reports (American Association of University Women (1992) and popular trade books [e.g., Pipher (1994); Sadker & Sadker (1994)], eventually catalyzed federal policy for girls, particularly the 1994 Gender Equity in Education Act. The act brought considerable new *inputs* into the ecology, as government funding briefly flowed to girls' education. Key changes have occurred in the *extant conditions* of gender and education since the late 1990s, however, with a perceptible *boy turn* (Weaver-Hightower, 2003) occurring in gender and education policy and practice. One might view this turn as a *succession* in the policy ecology."

#FSP Weiler. K. 1988. *Women Teaching For Change: Gender, Class and Power*. Bergan & Harvey. Amazon.com information at < http://www.amazon.com/Women-Teaching-Change-Critical-Education/dp/0897891287 >. Note the "Search Inside" feature.

#FSP Weiler, K. ed. 2001. *Feminist Engagements: Reading, Resisting, and Revisioning Male Theorists in Education and Cultural Studies*. RoutledgeFalmer. Amazon.com information at < http://tinyurl.com/55dp9n >.

PRODUCT DESCRIPTION: *Feminist Engagements* is a collection of original essays by some of the top names in feminist education, in which they read, resist and revision the works of the major twentieth-century theorists in education and cultural studies. These essays provide an excellent feminist introduction to such important scholars as John Dewey, W.E.B. Dubois, Michel Foucault, Stuart Hall, Paulo Freire, and Antonio Gramsci. Contributors include: Patti Lather, Alice Pitt, Jane Kenway, Annette Henry, Madeleine Arnot, among others.

#LPE *Weisz, P.B. 2004. "Basic Choices and Constraints on Long-Term Energy Supplies," *Physics Today* **57**(7); 47-52; online at < http://fire.pppl.gov/energy_choices_pt_0704.pdf > 896 kB):

"Population growth and energy demand are exhausting the world's fossil energy supplies, some on the timescale of a single human lifespan. Increasingly, sharing natural resources will require close international cooperation, peace, and security. . . .[our insert - and the help of women in science/math]. . . . ."

#FSP Wertheim, M. 1997. *Pythagoras' Trousers*: *God, Physics, and the Gender Wars*. Norton. Amazon.com information at < http://www.amazon.com/Pythagoras-Trousers-Physics-Gender-Wars/dp/0393317242 >. Note the "Search Inside" feature. [See the review by Markowitz (2000).] From the back cover:

Why are there so many physics books with "God" in their titles? In *Pythagoras' Trousers* Margaret Wertheim argues that from its inception physics has been a religiously inspired activity – a science based on a conception of God a a divine mathematical creator. In this highly accessible book, she offers an astute cultural and social history from ancient Greece to our own time. Moreover, Wertheim suggests that the priestly culture of physics has served thoughout the ages as a powerful barrier to the entry of women.

White, G. 2005. "Encouraging Women in Physics is Based on Rudimentary Sense of Fairness," *APS News*, July; online at < http://www.aps.org/publications/apsnews/200507/viewpoint.cfm >. A response to "Time to Confront Political Asymmetry in Physics" [Warden (2005)].

White. H. 1982. Review of *Fair science: Women in the scientific community* by Cole (1987 – first printing 1979). *American Sociological Review* **87**(4): 951-56.

White, P.E. 1992. *Women & Minorities in Science and Engineering: An Update*. Online at ERIC as a 4.6 MB pdf at < http://tinyurl.com/6z5vrp >. A Google "Book Preview" is online at < http://tinyurl.com/4fa8ed >. The abstract reads:

"Effective policy formulation depends on an assessment of the current situation and of recent trends in science and engineering participation rates of all segments of U.S. society. This volume, the sixth in a series, is designed to provide such an assessment. It has been prepared for the Congress, the administration, and others who influence the direction of the U.S. science and engineering effort and who are concerned with maintaining equal opportunity and equal treatment for women and minorities as they participate in this undertaking. The chapters in this book are: (1) Women in Science and Engineering; (2) Education and Training of Women in Science and Engineering; (3) Minorities in Science and Engineering; (4) Education and Training of Minorities in Science and Engineering; and (5) Persons with Physical Disabilities in Science and Engineering."

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Whitten, B.L, S.R. Foster, & M.L. Duncombe. 2003. "What Works for Women in Undergraduate Physics? : The predominance of men in physics remains a puzzle. To attract talented women and minorities, the culture of college physics needs a makeover." *Physics Today* **56**(9): 46-51, September, online at
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For responses to this article by Chris Paulse, John McNabb, & Rebecca Barthelmie; and a reply by Barbara Whitten see *Physics Today* **57**(3): 46-51 March 2004, online at
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Whitten, B.L., S.R. Foster, M.L. Duncombe, P.E. Allen, P. Heron, L. McCullough, K.A. Shaw, B.A.P. Taylor, H.M. Zorn. 2003. "What Works? Increasing The Participation Of Women In Undergraduate Physics" *J. Women and Minorities in Sci. and Eng*. **9**(3&4): 239-258; abstract online at < http://tinyurl.com/3w23h7 > :

"The physics community has been concerned about low participation by women for many years. Progress has been made, but the percentage of women in undergraduate physics is still less than half that in mathematics and chemistry. To learn 'what works' in attracting and retaining women in the undergraduate physics major, the authors conducted site visits to nine undergraduate physics departments and compared those with high participation by women to those that are typical of the national average. This article details the first results of the research, showing that a strong, inclusive, female-friendly department culture is like a fabric woven on a loom. No one factor is essential, but many small factors weave together to form a sturdy fabric. Institutions, faculty members, and students all have roles to play in creating this culture. Successful schools reach out to introductory students and integrate them into department cultures. Other results of this research will be described in a second publication."

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"We are studying the recruitment and retention of women in undergraduate physics by conducting site visits to physics departments. In this second phase of the project, we visited six physics departments in women's colleges. We compared these departments to each other and to the nine departments in coeducational schools that we visited in phase 1 of the project (Whitten, Foster, & Duncombe, 2003a; Whitten *et al*., 2003b; Whitten *et al*., 2004). We learned that women's colleges, much more than coed schools, try to recruit students into the physics major. This has led us to criticize the 'leaky pipeline' metaphor often used to describe women in physics and to call attention to women dropping in to the physics pipeline. We discuss our results for students and pedagogy and for faculty and institutions, and we offer some advice on how to make a physics department more female friendly."

#IE *Wieman, C. & K. Perkins. 2005. "Transforming Physics Education," *Phys. Today* **58**(11): 36-41; online as a 292 kB pdf at < http://tinyurl.com/4py56v >. [Wieman is a 2001 Physics Nobelist.]

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WIGSAT. 2008. Women, Knowledge, Technology (Ontario, Canada); online at < http://www.wigsat.org/front_page >. WIGSAT states :

> WIGSAT is a consulting group whose guiding principle is that women should have the opportunity to make full, active, informed and creative contributions to the science and technology-based knowledge society. They should be able to benefit from its advantages equally with men, including access to and use of technologies and full participation in innovation systems.
>
> It works with an international network of collaborators, partners and clients in three programme areas – Technology for Development, ICT for Development, and Science, Technology and Innovation Systems – to:
>
> a. Produce reports on major issues relating to global gender dimensions of ICT, technology and innovation systems,
> b. Engage in policy analysis and research,
> c. Develop gender assessments of policy and programming in ICT, technology and innovation systems,
> d. Encourage knowledge networking among a wide range of stakeholders.

#SDMA Williams, W.M. 2002. "Women in Academe, and the Men Who Derail Them," *STATUS*, January, online at < http://www.aas.org/cswa/status/statusJan02c.pdf > (1.2 MB). See also Ceci & Williams (2006).

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#LPE *Wilson. E.O. 1998. *Consilience: The Unity of Knowledge*. Knopf. Amazon.com information at < http://www.amazon.com/Consilience-Knowledge-Edward-O-Wilson/dp/067976867X >. Note the "Search Inside" feature. Wilson wrote:

> "The global population is precariously large, and will become much more so before peaking some time after 2050. Humanity overall is improving per capita production, health, and longevity. But it is doing so by eating up the planet's capital, including natural resources and biological diversity millions of years old. Homo sapiens is approaching the limit of its food and water supply. Unlike any species before, it is also changing the world's atmosphere and climate, lowering and polluting water tables, shrinking forests, and spreading deserts. Most of the stress originates directly or indirectly from a handful of industrialized countries. Their proven formulas for prosperity are being eagerly adopted by the rest of the world. The emulation cannot be sustained, not with the same levels of consumption and waste. Even if the industrialization of the developing countries is only partially successful, the environmental aftershock will dwarf the population explosion that preceded it."

#LPE *Wilson. E.O. 2003. *The Future of Life*. Random House, publisher's information at < http://www.randomhouse.com/catalog/display.pperl?isbn=978067976811 >:

"One of the world's most important scientists, Edward O. Wilson is also an abundantly talented writer who has twice won the Pulitzer Prize. In this, his most personal and timely book to date, he assesses the precarious state of our environment, examining the mass extinctions occurring in our time and the natural treasures we are about to lose forever. Yet, rather than eschewing doomsday prophesies, he spells out a specific plan to save our world while there is still time. His vision is a hopeful one, as economically sound as it is environmentally necessary. Eloquent, practical and wise, this book should be read and studied by anyone concerned with the fate of the natural world."

*Wilson K.G. and B. Daviss, 1994. *Redesigning Education* (Henry Holt); Amazon.com information at < http://tinyurl.com/6f7qce >. [Wilson is a 1982 Physics Nobelist.] Teachers College Press information at < http://store.tcpress.com/080773585X.shtml > :

"Midst the welter of proposals for school reform, Kenneth Wilson's boldly conceived and carefully argued vision deserves the widest attention."– Howard Gardner, Harvard University

#CS *Wilson, K.G. & C.K. Barsky. 2001. "From Social Construction to Questions for Research: The Promise of the Sociology of Science," Chapter 11 in Larbinger & Collins (2001).

#CS *Wilson, K.G. & C.K. Barsky. 2001. "Beyond Social Construction," Chapter 34 in Larbinger & Collins (2001).

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*Wilson, S.M. 2003. *California Dreaming: Reforming Mathematics Education.* Yale University Press, publisher's information at < http://yalepress.yale.edu/yupbooks/book.asp?isbn=0300094329 > :

"This compelling book tells the history of the past two decades of efforts to reform mathematics education in California. That history is a contentious one, full of such fervor and heat that participants and observers often refer to the 'math wars.' Suzanne M. Wilson considers the many perspectives of those involved in math reform, weaving a tapestry of facts, philosophies, conversations, events, and personalities into a vivid narrative. While her focus is on California, the implications of her book extend to struggles over education policy and practice throughout the United States."

A Google "book preview" is online at < http://tinyurl.com/3qwzab >. Amazon information at < http://tinyurl.com/67kdmx > : From the Back Cover:

"Wilson challenges the often facile and formulaic explanations given for the failure of educational improvement. She helps us to reframe the questions most important to ask and the problems most important to solve." - Deborah Loewenberg Ball, University of Michigan.

For a review see "Uncivil War" by Ralph Raimi (2004), professor emeritus of mathematics at the University of Rochester.

For yet more on this subject see "The Math Wars" [Schoenfeld (2003].

WISE. 2007. Working to Improve Schools and Education, online at < http://www.ithaca.edu/wise/ >. See "Gender Issues" at < http://www.ithaca.edu/wise/topics/gender.htm >.

WITI. 2008. Women in Technology International; online at < http://www.witi.com/ >.
Founded in 1989, WITI is the nation's leading trade association for professional, tech-savvy women committed to using technology, resources and connections to advance women worldwide. With a global network of smart, talented women and a market reach exceeding 2 million, WITI has established powerful strategic alliances and programs to provide connections, resources, and opportunities within a supportive environment of women committed to helping each other. WITI's mission is to empower women worldwide to achieve unimagined possibilities and transformations through technology, leadership and economic prosperity.

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Profiles < http://quest.arc.nasa.gov/women/WON.html >;
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* Wood, W.B. 2003. "Inquiry-Based Undergraduate Teaching in the Life Sciences at Large Research Universities: A Perspective on the Boyer Commission Report," *Cell Biology Education* **2**: 112-116; online at < http://tinyurl.com/6buwe5 >.

*Wood, W.B. & J.M. Gentile. 2003. "Teaching in a research context," *Science* **302**: 1510; 28 November; online to subscribers at
< http://www.sciencemag.org/content/vol302/issue5650/index.shtml-policyforum >. A summary is online to all at
< http://www.sciencemag.org/cgi/content/summary/302/5650/1510 >. They wrote:
"Unknown to many university faculty in the natural sciences, particularly at large research institutions, is a large body of recent research from educators and cognitive scientists on how people learn [Bransford et al. (2000)]. The results show that many standard instructional practices in undergraduate teaching, including traditional lecture, laboratory, and recitation courses, are relatively ineffective at helping students master and retain the important concepts of their disciplines over the long term. Moreover, these practices do not adequately develop creative thinking, investigative, and collaborative problem-solving skills that employers often seek. Physics educators have led the way in developing and using objective tests [Hestenes et al. (1992), Hake (1998a), Beichner & Saul (2004, NCSU (2008b)] to compare student learning gains in different types of courses, and chemists, biologists, and others are now developing similar instruments . . . .[our insert - see "Formative Pre/post Tests For Various Disciplines" (Hake, 2008f)]. . . . . These tests provide convincing evidence that students assimilate new knowledge more effectively in courses including active, inquiry-based, and collaborative learning, assisted by information technology, than in traditional courses" [Hake (1998a), Beichner & Saul (2004)].

WSQ. 2008. *Women Studies Quarterly*, online at < http://www.feministpress.org/wsq/ > :
An Educational Project of the Feminist Press at CUNY and the Center for the Study of Women and Society at The Graduate Center, City University of New York.

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Women's Freedom Network. 2008. Online at < http://www.womensfreedom.org/ > :

"The Women's Freedom Network was founded in early 1993 by a group of women who were seeking alternatives to extremist ideological feminism and the anti-feminist traditionalism. It believes in the full participation of women in every area of American life. It celebrates the achievements women have already made, and it views women's issues in light of a philosophy that defines women and men as individuals and not in terms of gender. It does not set different standards of excellence, morality, or justice for men and women."

Wyer, M. ed. 2001. *Women, Science and Technology: A Reader in Feminist Science Studies*. Routledge. Amazon.com information at < http://tinyurl.com/2yoz6s >. Note the "Search Inside" feature.

Xie, Y. & K.A. Shauman. 2005. *Women in Science: Career Processes and Outcomes*. Harvard University Press, publisher's information at
< http://www.hup.harvard.edu/catalog/XIEWOM.html >:

"Why do so few women choose a career in science--even as they move into medicine and law in ever-greater numbers? In one of the most comprehensive studies of gender differences in science careers ever conducted, *Women in Science* provides a systematic account of how U.S. youth are selected into and out of science education in early life, and how social forces affect career outcomes later in the science labor market.

Studying the science career trajectory in its entirety, the authors attend to the causal influences of prior experiences on career outcomes as well as the interactions of multiple life domains such as career and family. While attesting to the progress of women in science, the book also reveals continuing gender differences in mathematics and science education and in the progress and outcomes of scientists' careers. The authors explore the extent and causes of gender differences in undergraduate and graduate science education, in scientists' geographic mobility, in research productivity, in promotion rates and earnings, and in the experience of immigrant scientists. They conclude that the gender gap in parenting responsibilities is a critical barrier to the further advancement of women in science."

Amazon.com information at
< http://tinyurl.com/3y8jgx >. Note the "Search Inside" feature. A review by Sue Rosser is at
< http://www.sciencemag.org/cgi/content/summary/302/5650/1506 >.

A scholarly review and analysis of gender issues in science and math education.

Yanowitz, K.L. & S.S. Vanderpool. 2004. "Assessing Girls' Reactions to Science Workshops *Journal of Science Education and Technology* **13**(3): 353-359 September 2004; online to subscribers at < http://tinyurl.com/2wnoxu >.

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< http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=63&Issue=3 >. The abstract reads:

"How can educators assess and address the lack of interest exhibited by underrepresented youth in science? What strategies can be employed to recruit and retain these young people? Along with a bibliography, the author provides the reader with a brief summary of 20 notable works in the field of recruitment and retention of underrepresented students in math and science. Although highlighted retention and intervention programs reported herein are targeted at young women in particular, many of the suggested strategies are applicable to all students regardless of race, gender, or socio-economic background. It provides scientists who have an interest in science education with basic literature addressing this topic."

Zerega, M.E., G.D. Haertel, S-L Tsai, and H.J. Walberg. 1986. "Late adolescent sex differences in science learning." *Science Educ*. **70**: 447-460.

Zoller, U. and D. Ben-Chaim. 1990. "Gender differences in examination-type preferences, test anxiety, and academic achievement in college science education—a case study." *Science Educ*. **74**: 597-608.

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< http://www.questia.com/PM.qst?a=o&d=104385627 > has a "Look inside this book" feature that includes the Table of Contents. Amazon.com information at
< http://www.amazon.com/Outer-Circle-Women-Scientific-Community/dp/0300054394 >:

From Library Journal:
The editors of this book have brought together a selection of essays that discuss, in depth, the barriers met by women scientists. They provide no easy answers and suggest several areas where considerably more research is needed. In addition to the most current research in this area, the book also includes candid interviews with three eminent women scientists: Salome Waelsch, Andrea Dupree, and Sandra Panem. The concluding chapter presents a "theory of limited differences" that demonstrates how small disparities (from the male norm) throughout a female scientist's career can create a virtually unassailable barrier to professional success. This is an objective, thorough treatment that deserves wide reading.

Hilary D. Burton, Lawrence Livermore National Lab, Livermore, California

Zull, J.E. 2002. *The Art of Changing the Brain: Enriching the Practice of Teaching by Exploring the Biology of Learning*, Stylus Press. Stylus information at
< http://styluspub.com/Books/BookDetail.aspx?productID=44780 >.

Zull, J.E. 2003. "What is 'The Art of Changing the Brain?' " New Horizons for Learning, online at < http://www.newhorizons.org/neuro/zull.htm >. See also Zull (2002).

Please Go to Part 2 to Bring Up Some of the Above References *In Subject Order* As Indicated in the Abstract:

(a) Affirmative Action;
(b) Constructivism: Educational and Social;
(c) Drivers of Education Reform and Gender Equity: Economic Competitiveness and Preservation of Life on Planet Earth;
(d) Education and the Brain;
(e) Gender & Spatial Visualization;
(f) Harvard President Summers' Speculation on Innate Gender Differences in Science and Math Ability;
(g) Hollywood Actress Danica McKellar's book *Math Doesn't Suck*;
(h) Interactive Engagement;
(i) International Comparisons;
(j) Introductory Physics *Curriculum S* (for Synthesis);
(k) Is There a Female Science? – Pro & Con;
(l) Schools Shortchange Girls (or is it Boys)?;
(m) Sex Differences in Mathematical Ability: Fact or Artifact?;
(n) Status of Women Faculty at MIT.