2004 Literature Review

WOMEN IN ENGINEERING:
A REVIEW OF THE
2004 Literature

LISA M. FREHILL, LAUREN N. KETCHAM, CECILY JESER-CANNAVALE
ADVANCE: INSTITUTIONAL TRANSFORMATION PROGRAM, NEW MEXICO STATE UNIVERSITY

Overview

For this year's literature review, the ADVANCE team at New Mexico State University collected 299 sources published in 2004 and early 2005. Of those, 123 were journal articles that appeared across a wide array of disciplines. There were 14 dissertations, 37 conference proceedings papers (or entire conference proceedings), seven reports, and 118 items from newspapers, magazines, electronic sources, and other media. A total of 130 resources were finally included for examination in this year's review.

The process of assembling the literature review requires an enormous effort. The ADVANCE Program staff search online databases several times throughout the year, ordering many references via inter-library loan. In this literature review, as in the past, we focus our attention on the findings presented in peer-reviewed journals or large-scale reports by reputable organizations. While there are quite a few articles about women in engineering that appear in various trade magazines, most of these do not report original research findings. We tend to prioritize research that has been subjected to peer-review, such as journal articles and books from academic presses rather than magazine articles, which have not usually been subjected to similar review.

We have also found that even peer-reviewed articles suffer from substantial methodological flaws that call into question the reliability, validity, and generalizability of the authors' findings. For example, some articles report findings based on convenience samples, have unacceptably low response rates, or fail to report response rates at all. In some instances we chose not to discuss the most severely flawed articles even though we do describe key methodological features so readers will be aware of each study's strengths and weaknesses.

Many dissertations about women and diversity in science and engineering were produced in 2004. More than a dozen were collected for this review. Both qualitative and quantitative (about an even split), these dissertations covered subjects including girls' science education; college science experiences and persistence; recruitment and retention in academia; mentoring; and gender, race, and ethnicity issues. Many of the best dissertations discussed the interconnections of various oppressions in student and faculty success and representation in science and engineering.

The *Journal of Women and Minorities in Science and Engineering* (JWMSE) continues to be the predominant location of most of the research on gender and engineering. Without this peer-reviewed journal, many of the articles that appear therein would be spread across disciplines and, indeed, a specific focus on engineering may be construed as "too narrow" for the more important national journals in some fields. Therefore, if you are interested in the most current research on women and engineering, you should subscribe to this important journal. Likewise, the proceedings for conferences like those for the Women in Engineering Programs and Advocates Network (WEPAN) provide another regular resource for information about programming and research on women and minorities in engineering. The WEPAN homepage http://www.wepan.org features a link to conference proceedings and reports. Because both of these resources are fairly common and well-known, we make reference in this review to only a few items from each, and, instead, dedicate space to sources that are possibly less well-known or more difficult to casually locate.

In addition, in the past year there was a special issue of the journal of the National Women's Studies Association, the *NWSA Journal*, dedicated to women's participation in science and engineering. Our review includes a couple of these articles, but we recommend that you carefully consider the others, all of which have been included in the references section. Pieces by Beoku-Betts, Bix, Bystydzienski, Hanson, Harris et al., Jackson, Kohlstedt, Niemeier & Gonzalez, Rosser and Valian were included in this important volume.

Of course, *SWE Magazine* is also an important source of reporting about the status of women in engineering. The organization has long been concerned with diversity, indicated by the many articles published this year that recognized the intersection of ethnic, racial, and gender issues for individuals pursuing careers in engineering. In a winter 2004 article, the National Action Council for Minorities in Engineering's (NACME) 30th anniversary was covered. SWE also covered such events as National Hispanic Heritage Month,

highlighting the necessity and benefits of diversifying the engineering profession (Reydman 2004).

There are many good sources of quantitative data about women's education in general (e.g., see the National Center for Education Statistics report *Trends in Educational Equity of Girls and Women: 2004*) and women's and minorities' participation in science and engineering (e.g., see the National Science Foundation's publication *Women, Minorities, and Persons with Disabilities in Science and Engineering, 2003*). The American Society for Engineering Education (ASEE) as well as many of the other engineering societies routinely include articles that highlight even more timely data than the National Science Foundation report on engineering and engineering technology enrollment and degrees awarded, often with the data disaggregated separately by gender and race / ethnicity (Gibbons 2004 and 2005).

"Big Stories" about Women in Engineering

This past year, several topics of interest to women in engineering have caught the media's attention or are of particular note. Perhaps one of the most important stories concerned the release of a new report by the American Association for the Advancement of Science (AAAS) and NACME titled S*tanding Our Ground: A Guidebook for STEM Educators in the Post-Michigan Era.* This is essential reading for administrators of targeted programs such as those for minorities in engineering (MIE) or women in engineering (WIE). In light of recent Supreme Court decisions, the report attempts to clarify the appropriate procedures and tactics that are legal for those administering programs aimed at recruiting and retaining these targeted populations.

In addition to a "Legal Primer," the report offers advice to program administrators. First, the report stresses that administrators need to work at their institutions to create a campus mission statement that embraces a commitment to diversity. Second, programs should be built around a specific, identified problem supported by data and related directly to the campus mission statement. Third, "race-neutral alternatives" and the possible deleterious effects that could occur to omitted populations as a result of criteria for providing benefits should be considered and appropriately documented. Fourth, the need for comprehensive data collection, internal and external networking, and continuous research, evaluation and analysis are emphasized as key components of any successful and compliant program. Lastly, the report underscores the need for adequate faculty recruitment and retention and emphasizes the importance of an allied relationship with leadership within the institution at every level. A free downloadable PDF version of the report is available at the AAAS Web site (http: / / www.aaas.org).

Many articles appeared in newspapers, magazines, and in the electronic media in 2004 concerning science- and engineering-based programs and summer camps designed to reach out to girls. One traveling camp called Exploring Interests in Technology and Engineering (EXCITE) sponsored by IBM provided more than 1,000 girls around the world last summer an opportunity to meet female scientists and participate in hands-on engineering projects. Another summer conference with a focus on increasing diversity within engineering for teachers, scientists, parents and students was the 28th Annual Summer Institute of the Southeastern Consortium for Minorities in Engineering (SECME) at the University of Houston with workshops, presentations, and hands-on activities. Other outreach efforts covered this year included ExxonMobil's Introduce a Girl to Engineering Day; the University of Washington's, Rural Girls in Science program ; and the University of California's, Mathematics Engineering Science Achievement (MESA) program.

Several articles reported about Smith College's Picker Engineering Program. Started in 1999, this is the first engineering program established at an all-women's college and its first all-female class of engineers graduated in May 2004. The engineering program at Smith College is noted for its basis in the humanities and its rigorous, comprehensive requirements. According to Grasso (2004), the founding director of the Picker Engineering Program, engineering is defined as "the application of mathematics and science to serve humanity," and Grasso, Callahan & Doucett (2004) describe Smith's engineering program as "redefining engineering education" (p. 414). They point to at least three unique aspects of the Picker Engineering Program. The first is an emphasis on "unity of knowledge," which redefines engineering more inclusively and emphasizes its relationship to other sciences, the humanities, and social issues. The second is a focus on quantitative literacy, which they feel is often overlooked throughout a student's science education, but is a vital building block to broad-based knowledge. Third, they nurture entrepreneurship, corporate-student partnerships and industry problem-solving, while at the same time supporting engineering projects that lack corporate appeal. The Picker Engineering Program represents an exemplary new approach to engineering education. If past trends for graduates of women's colleges hold true, this program is likely to produce new leaders in the engineering profession.

Accomplishments of current women engineering leaders were also popular magazine topics. In Fall 2004, *SWE Magazine* spotlighted two female engineering deans, Dr. Belle Wei of San Jose State University and Dr. Janie Fouke of Michigan State University, as part of a yearly series exploring the influence female leaders have on the engineering profession (Layne). *U.S. Black Engineer and Information Technology* featured a number of biographies of women leaders in engineering associations and their impact on the profession. These leaders included Susan Skemp (past president of

the American Society of Mechanical Engineers), LeEarl Bryant (the first female president of the Institute of Electrical and Electronics Engineering - USA), Teresa Helmlinger (the first woman president of the National Society of Professional Engineers), Dianne Dorland (president of the American Institute of Chemical Engineers), and Patricia Galloway (president of the American Society of Civil Engineers) (Phillips 2004). Finally, the November 2004 issue of *Prism* (ASEE's magazine) featured a story about Sherra E. Kerns, the society's president (Halford). Dr. Kerns is now the vice president for innovation and research at the new Franklin W. Olin College of Engineering. Her platform for the presidency of ASEE includes increasing opportunities for women and minorities to pursue engineering.

The annual WEPAN Conference was held in Albuquerque, New Mexico, this year and featured speakers Patti Lopez of Hewlett Packard and Sandra Begay-Campbell of Sandia National Laboratories. Both of these leaders are natives of New Mexico: their inclusion as keynote speakers at the conference provided an opportunity for WEPAN to highlight the accomplishments of two important women-of-color in engineering (Lopez is a Latina, while Begay-Campbell is Navajo).

There was much reporting related to two other "big stories" about women engineers as academic leaders: Susan Hockfield's selection as president of MIT and Denise Denton's advancement to chancellor of the University of California-Santa Cruz. At least a dozen stories appeared in the national electronic media, newspapers, and magazines about Hockfield, former Yale University provost, between October 2004 and January 2005. (See Symond's piece in *Business Week Online* for a particularly good summary of the story.) Additionally, at least 19 different articles appeared reporting on Denise Denton's appointment as chancellor to the University of California-Santa Cruz. An electrical engineer, Denton had been the University of Washington's engineering dean (and, she is openly gay) (Bartindale 2004).

Many articles in 2004 reported on Donna Nelson's research about the representation of women and minorities among the faculty in 14 science and engineering fields at the country's 50 most elite departments. Nelson explained the scarcity of women and minorities as a result of considerable barriers to diversity including few mentoring opportunities, problematic hiring patterns, obstacles in the tenure process, and a clustering of women and minority faculty at the lowest ranks in their departments at these elite institutions. Nelson's data and reports are available at her homepage: http://cheminfo.chem.ou.edu/faculty/djn/djn.html.

Diversity in the Professoriate

Donna Nelson's research was one of many studies that examined diversity in the engineering professoriate. The first-round NSF-funded ADVANCE schools were closing out their third year of programming in 2004 while a new cohort of 10 schools finished their first year. ADVANCE pro-

TRENDS IN EDUCATIONAL EQUITY OF GIRLS AND WOMEN

The National Center for Education Statistics (NCES) recently released a new report *Trends in Educational Equity of Girls and Women: 2004.* Key findings from that report are:

- "In terms of many learning opportunities, males and females start school on a similar footing. In certain areas, females appear to start school ahead." (p. 2)
- "Females are less likely than males to repeat a grade and to drop out." (p. 2)
- "On a variety of measures, males seem to be more likely than females to experience serious problems at school and to engage in risky behaviors." (p. 3)
- "High school seniors' attitudes towards school have become increasingly negative, particularly among females." (p. 3)
- "Females have consistently outperformed males in reading and writing." (p. 4)
- "There are some gender differences favoring male students in mathematics and science." (p. 6)
- "Females are just as likely as males to use computers at home and at school." (p. 7)
- "Females are more likely than males to participate in various afterschool activities, except athletics." (p. 8)
- "Female high school seniors tend to have higher educational aspirations than their male peers." (P. 9)
- "Females are more likely than males to enroll in college the fall immediately following graduation from high school." (p. 9)
- "A majority of undergraduates are female" (p. 10)
- "Females make up the majority of graduate, but not first professional students." (p. 10)
- "Females are more likely than males to persist and attain degrees." (p. 12)
- "Degrees in certain fields of study continued to be disproportionately awarded to males or females, although changes have occurred in recent years." (p. 12)
- "Females have made substantial progress at the graduate level overall, but still earn fewer than half of the degrees in many fields." (p. 12)
- "Gender differences in participation rates in collegiate sports have narrowed." (p. 12)
- "Employment rates for females have increased across all levels of educational attainment since the 1970s." (p. 14)
- "Females with bachelor's degrees tend to earn less than males with the same level of educational attainment, but the gap is narrowing." (p. 14)
- "Females ages 25-64 have lower labor force participation rates than males, regardless of education, but participation increases with education." (p. 14)
- "Females are more likely than males to participate in adult education." (p. 14)

grams seek to increase recruitment, retention, and advancement of women in the professoriate. Each funded institution (funding levels are $3.5 million or more for five years) works as part of the ADVANCE community to better understand the social forces that affect women's participation in academia. ADVANCE program personnel attended conferences in many disciplines to disseminate the results of their programs in order to encourage other institutions to adopt similar strategies.

With a new National Science Foundation report (Rapoport, Bentley & Wise 2004), a new book on faculty diversity (Moody 2004a), journal articles (Jackson 2004; Mantani 2004; Valian 2004) and various magazine articles (Gordon & Keyfitz 2004; Layne 2004; Moody 2004b) questions, answers and solutions to the underrepresentation of women and minorities at the pinnacle of the U.S. science and engineering enterprise was the focus of much attention beyond the ADVANCE efforts. In many cases, as in the past, this literature featured pieces that did an excellent job on one dimension of diversity while treating other dimensions of diversity only superficially. Unlike in previous years, however, the number of counter-examples (i.e., literature that dealt with ethnicity and gender simultaneously) seems to be increasing. Frehill (2004) reviews the engineering pipeline by race / ethnicity and gender. Riskin et al. (2004) provide an important document (available online) for those interested in increasing diversity in the engineering professoriate, which was compiled as a result of a conference on the topic.

The question remains: Why are there so few people of color among the professoriate? According to a 2003 book by Cole & Barber, the principal issue in diversifying the professoriate in science (and, by extension, engineering) depends upon academia's ability to deal with what economists call "supply side" issues rather than "demand side" issues. "Supply side" refers to the notion that characteristics of underrepresented minority groups account for their low participation rates, while those who advocate "demand side" forces as responsible for low participation cite institutional racism and other actions by employers as the cause of disparity. Cole & Berber argue that low average educational attainment among African Americans and Latinos / as is the principal reason that these groups are not highly represented among the professoriate. Their study examines the fields chosen by high-achieving African-American and Latino / a college students. They indicate that without early mentoring, including research experiences as undergraduates, high-achieving underrepresented minority students will continue to choose economically lucrative areas like medicine and law rather than the comparatively lower economic rewards of academia.

Maton & Hrabowski (2004) report on a "strengths-based" approach to increasing the number of African-American Ph.D.s in science and engineering that has been quite successful at the University of Maryland, Baltimore County (also a "second round" recipient of an ADVANCE: Institutional Transformation grant). Their approach has incorporated many elements cited as essential by the supply-siders Cole & Barber, such as early identification of students with an interest in academia and interventions to improve the human capital of the African-American student participants with important bridges between secondary and post-secondary school.

Smyth & McArdle (2004) used data from 23 colleges included in the 1989 dataset "College and Beyond" to examine persistence in science for the 5,074 students who had declared an intention to major in science. The authors found support for the notion that at selective institutions, prior academic preparation explained the high persistence rates of Asians (highest) and whites and the comparatively lower persistence rates among American Indians, Hispanics, and African-Americans. Prior academic preparation also explained the gap between men's and women's persistence rates. The authors' analysis did not support the notion that more selective colleges had higher persistence rates than less selective colleges.

The actions and structure of colleges and universities (demand-side) were the focus of much attention from scholars interested in campus diversity and campus climate. Smith's (2004) report on a campus diversity project, also available online, focuses on the role that institutions can play in attracting a diverse professoriate. Likewise, the General Accounting Office released in July, 2004 a report titled, *Gender Issues: Women's Participation in the Sciences Has Increased, but Agencies Need to Do More to Ensure Compliance with Title IX*, which emphasizes the key role that institutions must play in ensuring equal opportunity in science and engineering. Crowley et. al. (2004) discuss the importance of minority campus-climate perceptions and suggest ways in which climate might be improved in the laboratory and at the institution more broadly. The authors note the various moral and utilitarian benefits associated with STEM field diversity in academia and provide indicator questions that should be considered when analyzing campus climate, including: "Is it easy for me to find people at my workplace of the same race?", "Have I ever been expected to speak for all members of my race?", "Are my differences in race accepted?", "Do I feel isolated due to race differences?", and "Do I feel excluded because of race differences?" (Note: we have edited some questions because the original form was imprecise). Additionally, the authors provide ideas for enhancing climate including: developing tasks that can be done in teams, ensuring that leaders consider all perspectives when making decisions; bringing in external consultants to do tolerance training; getting together informally outside of

work; mentoring; and implementing tough policy to ensure respectful workplace-conduct.

Brown's dissertation (2004) used a national sample of African-American undergraduate engineering students to determine their attitudes toward campus climate. Contrary to prior literature on climate, Brown found African-American students' perceptions of climate to be positive. Like other researchers, Brown found that more selective colleges and Historically Black Colleges and Universities had higher rates of retention than less selective colleges.

ENGINEERING CONFERENCES 2004

At this year's American Society for Engineering Education (ASEE) Annual Conference and Exposition, "Engineering Education Reaches New Heights", a number of papers salient to the topic of women and engineering were presented. The conference held in Salt Lake City last summer had many interesting sessions including: "K-12 Engineering: The Future is in our Hands," "The Changing Face of Engineering," and "What Will it Mean to be Educated in the 21st Century." The conference generated dozens of articles, all of which could not be discussed here, but they are all available for free PDF downloading at the ASEE Web site.

Many authors tackled the subject of mentoring female engineering students (for example, Dockter 2004 and Demir 2004). In addition, at least two articles discussed community-based approaches to mentoring. Eschenbach & Cashman (2004) describe a community-based service-learning project which blends youth outreach, peer mentoring, and community service undertaken by the Humboldt State University section of the Society of Women Engineers. A similar project initiated by Utah State University's SWE section worked collaboratively with local girl scouts to increase interest in engineering and build peer mentoring networks (Haupt & Gregory 2004).

Eight articles discussed the role of race and ethnicity in engineering outreach programs, recruitment, and persistence. Four of these discussed specific outreach projects. Llewellyn, Usselman, & Gaughan (2004) report on an NSF-funded Alternative Pathways to Success in Information Technology (APSIT) program; Kuyath & Yoder (2004) discuss the Diversity in Engineering Technology Project, the Junior Engineering Technical Society (JETS) and the Tests of Engineering Aptitude, Mathematics and Science (TEAM+S); Lawrey, Heyman & Rockland (2004) discuss the Pre-Engineering Instructional and Outreach Program (PrE-IOP); and Crawford & Schmidt (2004) discuss the University of Texas at Austin's Achievement in Mathematics for Engineering (AIM for Engineering) program. Taking into account a global, ethnically-conscious consideration of engineering, Sukumaran, Hartman & Johnson (2004) highlight a successful and inclusive engineering program in Kerala, India. Rochefort, Levien, Ford, & Momsen (2004), Purdy & Kane (2004) and Carver (2004) also discuss diversity in engineering topics.

Moreover many articles addressed programs and courses designed to increase female success in engineering (see Bogue & Litzinger 2004; Diefes-Dux et. al. 2004; Watford & Artis 2004; Pawley 2004, Reisberg et. al. 2004; Wasburn & Miller 2004; Rajala et. al. 2004; and Cano et. al. 2004 for examples). Other articles addressed subjects as various as female engineering student self-presentation (Waller 2004) and fine arts and engineering (Chesler & Riley 2004).

However, many articles at this conference suffer from common methodological problems such as small sample sizes, failure to report response rates, convenience sampling, and reporting on pilot studies which have yet to have time to produce any meaningful results, so readers should be aware of these shortcomings and weigh the results of these articles accordingly.

The 2004 ACM-SIGMIS CPR (Association for Computing Machinery Special Interest Group in Management Information Systems Computer Personnel Research) titled, "Careers, Culture and Ethics in a Networked Environment", was held in April in Tucson, Arizona. Several articles, some discussed elsewhere in this paper, addressed issues of gender, climate and lack of diversity within information technology. Roldan, Soe & Yakura (2004) examine the idea of workplace climate and women's perceptions of these climates as it relates to retention and success within IT organizations, proposing a future research design. Ahuja, Robinson, Herring & Ogan (2004) report on research-in-progress regarding an NSF funded pilot project at Indiana University to encourage women and girls to enter into IT fields and careers. Trauth, Quesenberry & Morgan (2004) argue that analysis of individual differences among women is important in understanding women's underrepresentation within IT. They reported on the first phase of interviews done with 44 women IT practioners and academics in Massachusetts, North Carolina, and Pennsylvania. Though only in its formative stages, the authors are concerned with the effects of personal data (demographic, lifestyle, and workplace information), shaping data (personal characteristics, personal influences), and the informant's environment (cultural attitudes and values, geographic data, economic data, etc.).

Two symposiums were held this year honoring female leaders in science — Marie Curie and Anita Borg. Urry and Thompson (2004) highlight the events and speakers of the Yale Symposium, "Marie Curie Nobel Centennial: Celebrating Women in Science", held in honor of the 100th anniversary of Curie's first Nobel prize. Panels and speakers at the three day symposium spoke about Curie's life and work and the difficulties and inequalities she faced. In addition, the contributions of women in science more generally and the challenges the sciences face were also topics of discussion. Yund (2004) discussed some of the main concepts underscored at the Anita Borg Celebration, held September 9, 2003 at Stanford University. Scientists and engineers in academia and industry spoke about Borg's life and contributions to the field. In addition, Yund emphasized the need for more inclusion of women in science, some reasons women are currently underrepresented, and aspects of changing the climate for women in science, engineering, and technology.

— by Lauren Ketcham

Demand-side forces were also the focus of two articles that appeared in a special issue of the *American Economic Review*. Following up on their 2000 book, Myers & Turner (2004) argue that persistent discrimination (e.g., tokenism, chilly climate, etc.) on the part of academic institutions plays a major role in the continued marginalization of minorities within the academy. Their economic models indicate that merely addressing the supply-side factors argued to be significant by Cole & Barber, will actually do little to alter the relative numbers of minority faculty compared to non-minority faculty.

In the same volume of the *American Economic Review*, three panelists, Slaughter, Ehrenberg, & Hanushek (2004), do a nice job of framing and synthesizing the demand-side and supply-side perspectives. This article emphasizes the need to look at both sets of factors to understand how to increase minority participation in the sciences and engineering. An important shortcoming of many sources mentioned in this section so far is the classic problem of overlooking gender when dealing with racial / ethnic issues. That is, none of these authors devotes significant attention to how gender effects the participation of underrepresented minorities in science and engineering, nor the unique problems that are encountered by women of color in the academy. While Moody (2004a and 2004b) tackles this persistent problem head-on, many authors still pose ethnic and gender equity as players in a zero-sum game.

Herzig's (2004) article, like the *American Economic Review* panelists, does an excellent job of examining both supply-side and demand-side issues. Synthesizing a wealth of literature on mathematics and doctoral student attrition, Herzig argues that persistence of students in doctoral programs is dependent on their level of integration into their institutions and departments (i.e., a "persistence framework"). Disproportionate attrition of women and minorities in mathematics may be attributed to their relative difficulty in participating meaningfully, or integrating, with faculty, other students, and in the classroom. Herzig identifies many common obstacles doctoral mathematics students face in achieving adequate participation and interaction in their studies. Several personal factors appeared as themes in Herzig's literature review, such as: women's relative lack of socialization in independence and autonomy, characteristics useful in degree completion; women's lack of confidence in their abilities; and the disproportionate burden of family responsibilities on women students. Interactive inhibitory factors Herzig identified included: the need for moral support; the inadequacy of current mentoring and advising schemes; feelings of loneliness; and women's distaste for competitive work environments. Lastly, Herzig identified community-based factors that partially explain attrition from doctoral mathematics, including: weak program structure and lack of supervision; lack of student financial support; institutions that fail to offer appropriate responses to a student's family's needs; and the state of the mathematics job market.

We again see the interplay of supply-side and demand-side factors in a study of Stanford Ph.D. recipients. Aware of doctoral attrition and decreasing rates of timeliness of degree completion, Maher, Ford, & Thompson (2004) conducted a study aimed at (1) identifying factors that facilitate or inhibit women's success in achieving a doctoral degree and (2) ascertaining the relative consistency of these constraints or aids in women who achieved their Ph.D.s over a short versus a long time span. A questionnaire was distributed to 295 doctoral alumni of Stanford University who had received their degrees between 1978 and 1989. A total of 160 respondents returned their surveys for a 54 percent response rate (which is considered unacceptably low). The authors identified six themes that either inhibited or facilitated timely graduation: commitment to degree completion, faculty networking, access to funding, family responsibilities, research experience and competence, and the capability of working within the academy's existing framework.

Patitu & Hinton (2004) also take on the subject of underrepresentation of minorities in academia analyzing what, if anything, has changed for African-American faculty and administrators in the academy. Based on five interviews with African-American women administrators and five interviews with African-American faculty members, the authors conclude that little has changed for the women they interviewed. Finally, they offer some tentative recommendations, such as encouraging professional networks, hiring multiple persons of color within a department to reduce isolation, diversity training, and policies of taking strict action against problem individuals as possible solutions to some of the problems identified by their interviewees. However, this like many other articles in the field, utilized what could be characterized as sketchy methodology. The sample size was small, the process by which the women were selected, other characteristics about the women, and other crucial components were not addressed at all, leaving the reader wondering about selection bias. However, the quotes and microanalysis provided were interesting to consider.

Finally, two dissertations this year made use of the Women's Experiences in College Engineering dataset (WECE). Curry at the Colorado School of Mines found that black women were more likely than other women to persist in engineering in college. Choudhuri's dissertation at the University of Iowa worked with a set of 18 personal and contextual variables to examine how self-efficacy affected commitment to the engineering major. Many other dissertations relied on local convenience samples, which may be interesting but provide limited insight into the larger social forces that

shape recruitment and retention into academia.

Motherhood and Academia. An important area of research related to women's participation in academia saw an explosion of attention in the past year. Many articles addressed the subject of balancing family with academic success. In *Academe*'s November / December 2004 special edition (Vol. 90, No. 6) titled, "Balancing Faculty Careers and Family Work," various issues related to women, families, and the academy are discussed. Quinn, Lange & Olswang (2004) and Sullivan, Hollenshead & Smith (2004) analyze the role of family-friend policies at universities. Lobel (2004) and Ward & Wolf-Wendel (2004) write about the challenges to career growth related to taking time off for children and family. Mason & Goulden (2004a and 2004b), Williams (2004), and Curtis (2004) also have articles in this addition relating to postponing children in the pursuit of an academic career, balancing work and family, and motherhood-based stereotypes in the workplace. The edition is available online at the AAUP Web site.

More specifically, Kelly and Wolf-Wendel (2004) determined how junior women faculty with small children manage their parental and professional roles at research universities. Twenty-nine women from nine different universities were formally interviewed. Thirteen of the women were from AAU top tier research universities and the other 16 were from other research-extensive universities. The interviewees were assistant professors currently on the tenure track or associate professors promoted within the past year who had children between the ages of birth and five years old. Four themes were found in the interviews with the women: joy in professional and personal roles, the idea of having both an academic and family life as "greedy," watching the clock to determine when to have children, and the way that having children puts work into greater perspective. The respondents found autonomy and flexibility allowed for them to be mothers, but also that this choice coincides with a never-ending workload, never having enough time in the day, the ambiguities of tenure expectations, and expectations for working a "second shift" at home. Policies will have to be reviewed by university administrators as they understand the experiences of junior faculty mothers.

Jacobs and Winslow (2004) analyzed data from the 1999 National Survey of Post-Secondary Faculty, which were supplemented with 2000 Census data. Their research documents the generally high workload of faculty members. On average, faculty members spent between 51 and 56 hours per week at work. Single women without children and married men (with and without children at home) spent the most time at their jobs (about 56 hours), with married women (with and without children at home) and single men spending less time (about 53 hours per week). Single parents spent the least amount of time at work, but still worked beyond the "normal" forty-hour work week: males averaged 52 hours while females averaged 51 hours. Among those who were married, female academics were also more likely than male academics to report that their spouse held a job, that their spouse worked full-time, and that their spouse was also an academic. Indeed,

29 percent of married male faculty but only 9 percent of married female faculty reported that their spousesdid not work in the paid labor force.

The Science and Engineering Workforce

Academia represents a small segment of the science and engineering workforce. This past year there were many articles that explored issues about the larger science and engineering workforce. These articles highlighted issues such as: the unfilled demand for skilled workers; workforce attrition; and the need to diversify and improve the climate of science and engineering to fill positions in this important portion of the job market.

The Commission on Professionals in Science and Technology issued a report of a conference titled, *The Changing Nature of Work and Workers in Science and Engineering*, in October, 2004. This comprehensive report provides details about the demographic characteristics of the current science and engineering labor force, with a focus on several specific science disciplines (i.e., chemistry, physics, psychology) and the rise of biotechnology. On a related note, in a one page spread, Wraige (2004) discusses research conducted by the Equal Opportunity Commission, which has identified the need to recruit and retain women in the engineering profession. Ideas include apprenticeships for women and girls and other strategies designed at introducing women to engineering and improving the profession's image.

Preston (2004) examines the problems associated with occupational exit from the science and engineering workforce. She acknowledges that regardless of gender and race, occupational exit rates from the natural and physical sciences far exceed the rates in the comparable social sciences. Preston offers a number of recommendations for simultaneously reducing attrition and making careers in the sciences more desirable, which would benefit both men and women pursuing careers in these fields. These suggestions include: ensuring that students of science are better informed about what they will encounter in scientific careers so they know if their expectations are likely to match their intended careers; increasing pay and nonmonetary benefits of science and engineering positions; establishing family-friendly policies such as dual career options, on-site day care, and flexibility in working hours; continuing formal mentoring opportunities for women encouraged by those at the top of the organization or institution; and providing skills-updates and training programs so men and women can stay on top of their ever-changing disciplines.

Reviewing literature on the recruitment and retention of women and minorities, Tapia & Kvasny (2004) review the components of the IT workforce crisis, discuss various theoretical perspectives, and offer suggestions to managers in the IT industry aimed at recruiting and retaining talented women and minorities in the field. According to the authors, currently women and minority IT employees lack access to mentors, have feelings of unmet expectations, experience stress, and are exposed to a male-dominated, sometimes hostile, workplace culture, all of which contribute to their low numbers in the industry. Among the authors' many recommendations to remedy this situation are: the development of role models and mentors, community-based workplaces with an emphasis on the importance of family, diversity and tolerance training, a focused effort on hiring more underrepresented groups into positions of power, counseling programs, and appropriately enforced employee conduct rules.

Research on K-12 Preparation for Engineering

Of course, when it comes to understanding the social forces that affect differential participation in engineering, the "pipeline" is a significant issue. The underrepresentation of women and minorities in the engineering professoriate in particular, and the engineering workforce in general, is likely to persist until K-12 educational differences for girls and especially minorities are addressed. The National Center for Education Statistics (NCES) recently released a new report titled, *Trends in Educational Equity of Girls and Women: 2004* (see box with key findings). In a nutshell, at the K-12 level, the math and computer usage gender gaps have disappeared; a small science proficiency gap remains; and girls outperform boys in reading and writing and are less prone to behavioral problems.

The NCES indicated that male students were favored in mathematics and science — but in far fewer ways than ten or fifteen years ago. Males were more likely to take AP exams in science and calculus but, in terms of performance, there were no significant differences between girls' and boys' proficiency in mathematics. There does remain a slight gap in girls' scores on AP science exams relative to boys' scores, and younger girls' proficiency scores lag behind those of younger boys' (fourth and eighth graders).

The availability of advanced placement (AP) courses has long been an issue for schools located in poor and minority communities. Klopfenstein (2004) documents the persistent gap between whites and minorities in participation in AP courses using data from the Texas Schools Microdata Panel for the 1998-99 academic year. These data included information from Texas public high schools about courses taken by 723 white students, 639 black students, and 719 Hispanic students. Data about AP courses in 19 different subjects were examined. Klopfenstein found that at least 50 percent of the gap between whites and minorities still existed after controlling for human capital factors. The effects of low-income status on the decision to enroll in an AP course were also examined.

Mathematics, Engineering, and Math Anxiety. Mathematics plays a significant role in engineering education. Leuwerke, Robins, Sawyer & Hovland (2004) examined the role of mathematics

achievement, interest congruence and retention of engineering students using a local longitudinal data set. The data are from a large database used by institutional research at a large southern university with approximately 19,000 undergraduate, graduate, and professional students. Students who declared engineering as their major when beginning their first semester were included in the study, resulting in the inclusion of 622 males and 222 females. Students' ACT mathematics scores was used as a measure of pre-college mathematics achievement and their level of occupational interest was measured using a standard scale known as the Hexagon Congruence Index. Students with higher math scores were more likely to remain on campus. Engineering majors were more likely to be retained when their mathematical achievement was high. However, those students with lower mathematics scores were retained if they had a high level of congruence with engineering. According to the authors, the best predictor of retention was the ACT mathematics score. Gender, race / ethnicity, age, socioeconomic status and in-state versus out-of-state residence had no significant effect on retention.

Even though the "math gap" in performance has disappeared, many advocates of women in engineering are concerned about how girls' and boys' experiences of mathematics differ. Hence, research on math anxiety, as one dimension of mathematics experience, continues to show interesting results. Haynes, Mullins & Stein (2004) surveyed a stratified random sample, by discipline, of undergraduate students enrolled in mathematics or statistics classes at Tennessee Technological University. Achieving a 96 percent response rate, they found that males' and females' levels of math anxiety were not significantly different. However, via multiple linear regression analysis, they found that the components of math anxiety differed for males and females. For males, math anxiety was a manifestation of general test anxiety, which was also negatively related to ACT scores. For females, on the other hand, math anxiety was positively related to both test anxiety and ACT scores and negatively related to perceptions of high school math teachers' attitudes, teaching methods, and perceptions of one's own mathematics ability. As a local study, however, it will be important for other researchers to replicate this study to determine whether these results hold true elsewhere.

Miller and Bichsel (2004) surveyed 100 adults that varied in age (18-66) and education levels (high school degrees to college graduates). The participants were tested for 1-2 hours on five measures: math performance, math anxiety, state-trait anxiety (state anxiety can vary over time and in different situations but trait anxiety is relatively stable), verbal working memory, and visual working memory. Math anxiety was determined to be the most important factor in predicting both basic and applied math performance. After math anxiety, both verbal and visual working memories were important in predicting basic and applied math performance. Math anxiety appeared to be predictive of females' performance in both basic and applied mathematics but math anxiety affected males more than females in basic math and was not significant for males in applied mathematics.

A more representative study of math anxiety was reported by Ma & Xu (2004). These researchers performed structural equation modeling on data from the nationally-representative Longitudinal Study of American Youth to sort out the causal ordering of math anxiety and math achievement. Low math achievement was related to subsequently higher levels of math anxiety but prior high math anxiety did not necessarily lead to lower math achievement. As with Haynes, Mullins & Stein, Ma & Xu found no significant effects of gender on this causal ordering.

Single Sex Environments. Over the past several years there has been much interest in determining the merits of single-sex education, especially for girls. The consensus is that in some situations same-sex education may be beneficial to girls, but it may not be ideal for all students. Some evidence suggests that girls and minority males benefit from same-sex classrooms, therefore, the single-sex option should be available but not required across all educational levels (see Frehill, Jeser-Cannavale & Benton-Speyer 2004 for a review of this literature). Robinson & Gillibrand (2004) examined the merits of single-sex schooling for girls in a Church of England urban secondary school. The impact of the single-sex context differed by the level of the science class. In lower level science classes, there were no effects associated with the single-sex model. But in the higher-level science classes girls and boys benefited from the single-sex context. They found that boys in these higher-level classes tended to need the girls to perform a variety of "services" such as help with practica. When the boys were not present, the girls were better able to focus their attention on the science rather than accommodating the boys' needs or adjusting for the boys' lower skills. At the same time, boys were forced to learn the skills that they had relied upon girls to provide.

Another study examined the impact of sex composition on science learning. Matthews (2004) compared 82 children working in mixed gender collaborative work groups with 83 control group children working mainly in single-sex groups in a school in England in one academic year. Using various sources of data (questionnaires throughout the study period and interviews with 40 percent of the students), Matthews found that there was a positive effect on social emotional skills associated with doing collaborative work in mixed groups. Students' opinions about science improved; with many stating that they intended to take science classes in the future.

Single-sex versus mixed sex groupings were

also examined in a three-year study of the perceptions and behaviors of academically suitable fourth, fifth, and six grade boys and girls who participated in a week-long Science Academy camp (Voyles & Williams 2004). During the first two summers the classes were single-sex, while in the third summer participants were in mixed-sex classes. The researchers observed that while boys volunteered to participate in the camp at a high rate, girls needed to be recruited to the camp. The authors relied upon data from various sources: students' daily surveys about accomplishments; interviews with some participants; and careful observations of videotaped behaviors. Girls showed a lack of interest at the beginning of the week. There was no significant difference in how boys and girls rated their success in the week-long program but over the course of the week, girls' self ratings of success increased until it was slightly higher than boys'. Girls asked more questions of the teachers than the boys, but both boys and girls were equally likely to ask peers questions. Boys were more likely than girls to make assured comments while girls made more failure statements. Because there were no substantial differences in findings across the three years of the study, despite the change from a single-sex to a mixed-sex model, the authors concluded that sex composition had no substantial impact on the students' success — male or female — in the program.

The Science Classroom. Many articles published in 2004 analyzed various aspects of the science classroom. Brown (2004) examined how ethnic minority students' culture and beliefs may conflict with the culture and practices of high school science classrooms. Because these students may have identities or personal beliefs that could conflict with mainstream science-teaching, they may need to negotiate their sense of self in these contexts. Brown held the role of researcher and teacher in two science classes — life sciences and biology — for the 1999-2000 academic school year. He videotaped the classroom, observed and recorded student behavior, reviewed written assignments, and interviewed the students in a large urban high school in Southern California. Brown found that students formed four types of discursive identities: Opposition status (students maintained distance from science classroom content), Maintenance status (students maintained their original identities while also being able to incorporate aspects of the science classroom), Incorporation status (students actively attempted to integrate science content into their personal vocabulary), and Proficiency status (students readily embraced and were proficient in the science classroom). Brown speculates that these discursive identities play a role in the underrepresentation of minorities in science occupations.

Klein (2004) studied the connection between gender and academic achievement in order to determine whether a student's or teacher's gender had any effect on grades. Grades and behavioral marks for 3446 students in grades five through 11 in 110 Israeli public schools were obtained. In addition, the author collected data to control for student and teacher gender, teacher seniority, the instructor's tendency to be more or less lenient, the student's age, class size, class subject matter, school size, and other factors. Approximately half of the grades

that were analyzed were submitted by female teachers and half were submitted by male teachers. Klein found that the variance in achievement was a result of the teacher's gender, while the student's gender played only a small role. Moreover, female teachers gave significantly higher grades than male teachers, and both male and female teachers gave higher scores to female students. When accounting for the other variables studied in the research, Klein concluded that female teachers are less biased and are less likely to allow extraneous factors to influence their grading.

Wasburn (2004) gives recommendations on how to make technological classroom friendlier so that women will not be discouraged from pursuing technology-driven careers because of a chilly climate in the classroom. She also gives a few exercises that an instructor can facilitate to improve gender equity in the technology classroom. Many of these recommendations echo those of previous researchers on the gendered dynamics of classrooms (most notably, the work of Sadker and Sadker 1994). In addition, though, Wasburn has a number of recommendations that relate to how the instructor or teacher can affect the learning environment such as: confronting sexist remarks; taking an active role in establishing teams (rather than letting students form their own teams); and rotating team assignments so that each teammember learns the different duties associated with participating on a team.

Programming for Women and Underrepresented Minorities in Universities

In the past 20-30 years, there have been many programmatic efforts aimed at increasing females' and minorities' participation in engineering. Some "women in engineering" (WIE) or "minorities in engineering" (MIE) programs feature outreach efforts to K-12 students, while other programs focus upon retention of undergraduate students. Knight & Cunningham (2004) address programmatic issues for administrators and directors of WIE / WISE programs. As part of the Women's Experience in College Engineering (WECE) project, telephone interviews and follow up surveys were administered to 26 WIE program directors across the country whose programs had existed for 3 or more years. The authors found that a strong base of support, flexibility, overcoming barriers to reaching undergraduate women, and a willingness to be adaptable and broad-based were typical features of successful outreach programs.

Another useful resource for MIE and WIE directors is an article by Jeffers, Safferman & Safferman (2004), who provide details about over 55 K-12 outreach programs run by colleges and universities throughout the country. The authors believe one way to improve children's skills in math and science is to integrate these outreach programs into existing core curriculums.

Harris et al. (2004) report on a pilot study dealing with the reasons that the University of Oklahoma is an "outlier" when it comes to gender. One half of the students are female—not unusual in industrial engineering—and 4 of the 10 professors in the program are female. The authors point out some interesting and potentially fruitful areas to which researchers interested in institutional transformation to bring about gender equity might want to attend. First, the authors identified a helpful administrative assistant and faculty who worked with open doors as a particularly welcoming climate for the students. Second, hands-on classroom activities are alluded to as an important curriculum feature that kept students engaged and interested in the field. An issue that the authors did not pursue, but which needs to be given more attention concerns an almost incidental comment in the manuscript about the denigration of industrial engineering. This is a significant issue: according to the sociological literature about occupations (for example, see work by Reskin & Roos 1990), as occupations transition from male to female majorities, it is common for the occupational prestige and rewards to be downgraded, leading to an increasing flight of men from the occupation. The extent to which engineering subfields with significant percentages of women (especially industrial engineering) experience downgrading, needs to be further explored. How do students react to these forces? Are men more likely to leave the field? Does such denigration lead to increased solidarity among students within the major being denigrated? How do racial / ethnic compositions affect these same areas?

An evaluation of a retention program called the Biology Undergraduate Scholars Program at the University of California, Davis was conducted by Barlow (2004). The 397 underrepresented minority students who agreed to participate in the program were compared to the 877 underrepresented minority students who opted not to participate between 1988 and 1994. The program was successful in increasing the retention of underrepresented minorities in biology, and increasing these students' success in basic math and science classes, with program participants more likely to graduate than non-participants.

Fadigan & Hammrich (2004) studied the long-term education and career trajectories of female participants in the Women in Natural Sciences (WINS) program. The authors fail to report a number of important details, and the response rate (51 percent) is unacceptably low, but the study involved an "under-studied" population. The girls had originally been accepted to the program based on several criteria: entering the ninth or tenth grade; C or better in all major subjects; one or both parents absent from household; and demonstrated financial-need. The study is unique in that it focuses on girls from single parent and low-income homes, a vast majority (89.5 percent) of the girls were racial minorities and most attended urban public high schools. Surveys were sent in to 152 women who participated in the program

between 1992 and 1997. In addition, 12 of those who completed surveys were asked to complete an interview. Prior to the WINS experience, the women held high educational and career aspirations leaning towards SMET-related careers such as scientist or doctor. According to the survey and program tracking records, all 117 participants in this case study graduated from high school and 93 percent of the women enrolled in some type of college program after high school and of those, 45 percent of the women have pursued science into adulthood as their choice of occupation. The majority of the participants perceived the science content they learned from WINS as having an influence on their education and career decisions 5-10 years later. Due to the unstable nature of the women's homes, the museum at which the program was run provided a secure, safe environment to these women.

Williams et. al. (2004) describe a new educational program funded by the National Science Foundation and developed by the Cornell Institute for Research on Children (CIRC) called "Thinking Like a Scientist." The program targets youth traditionally underrepresented in science and attempts to introduce these students to the process of scientific reasoning, including analyzing data, thinking critically, and reflecting on information. The program accomplishes this by basing its lessons in topics that are of natural interest to youth. Williams et. al. provide examples such as the effects of praise on children or the consequences of playing violent video games on children's behavior. In addition, students were asked to define the problem and consider its different sides, give examples from their own lives, distinguish between fact and opinion, consider what constitutes reliable evidence, weigh the evidence and make decisions about validity, consider what meaning the results may have for society, and reflect on what future scientific inquiry might reveal about the subject. Full evaluation of the program is pending more data and greater implementation.

Gender and Technology

At a more "global" level, there were a number of interesting studies about the relationship between gender and technology. These studies are important in understanding how the structure and content of engineering education might be better configured to appeal to more diverse groups of students. Historical analyses of the gendered construction of engineering and those that examine the role of stereotyping and perceptions of engineering are important subtopics under this heading. Because social structures and culture (which includes stereotypes and perceptions) are socially constructed, they are possible to change. At the heart of the research in this area is the notion that in order to bring more women into engineering, engineering needs to be seen as not just acceptable for young women, but also appropriate or normative for women.

Testing the often posited concept that digital technology may serve to diminish social inequality through greater access to information, Losh (2004) analyzed adult access to and use of computers, the Internet, and e-mail in order to ascertain if educational, occupational, or gender differences in use could be detected. Losh used data from the National Science Foundation's surveys of public use of science and technology conducted between 1983 and 1999, supplemented with General Social Survey's surveys conducted between 1999 and 2002. Losh found that although there has been some progress, considerable digital gaps remain with respect to gender, educational attainment, and occupation. Gaps in computer ownership remained; those with higher educational attainment and more occupational experience were more likely to own home computers than those with less education and less labor-force participation. Additionally, occupational computer use differed by gender, which relates to women's disproportionate employment in clerical work.

A nice literature review on gender, science and technology was provided by Adam, Howcroft & Richardson (2004), who analyzed journal articles published in ten information-systems journals from 1993-2002 to determine the extent to which gender issues have been considered and theorized in this literature. The nine quantitative papers that dealt with gender were simplistic interpretations of research findings about gender differences without much theory to understand the relationship between gender and technology. Hence, while the papers did make recommendations about curbing discriminatory practices in information systems, these were weak and half-hearted. Most of the seven qualitative studies were from international journals. The authors concluded that those interested in conducting research on gender and information sciences need to move beyond essentialist thinking and develop more complete theorizing about gender.

Similarly, Wilson (2004) notes that theoretical concepts and observations in sociology- and technology-management disciplines would enhance the understanding of information systems processes and gender inequity. Wilson presents data from sociology including the theoretical contributions of critical-mass theory and feminism to explain differences in information systems. A social constructivist perspective on gender and technology suggests that technology is to change, technology and gender are mutually defining and therefore what is deemed technical can alter over time, and technology is a masculine culture and this will affect user interaction.

The History of Engineering. New histories of engineering education are shedding further light on the challenges for those interested in transforming the institution of engineering. Two such articles provide insight into how engineering education was affected by gender in historical perspective. Frehill (2004) documents the early histo-

ry of engineering as a profession in the United States. Using historical sources like the *Engineering News*, proceedings from conferences of the Society for the Promotion of Engineering Education (now the American Society for Engineering Education: ASEE) and career guidance books, she documents how masculinity was embedded within the discipline as it moved increasingly toward a profession with strong academic requirements. Bix (2004) discusses the history of women's participation in engineering education. Women who sought engineering education struggled within hostile environments and often experienced difficulties in finding employment in the pre-Title IX era. Bix also notes women engineers' resistance to efforts to marginalize their work in the field.

In a more general article by Mraz (2004), in honor of *Machine Design's* 75th anniversary, Mraz interviewed five leaders of engineering organizations and asked them to report on changes the profession has experienced over this 75-year period. The leaders they interviewed were John Brooks Slaughter of the National Action Council for Minorities in Engineering (NACME), Bill Wulf of the National Academy of Engineering (NAE), Richard Tax of the American Engineering Association (AEA), Betty Shanahan of SWE, and Teresa Helmlinger of the National Society of Professional Engineers (NSPE). In the eight page visually-appealing spread, the subjects of growth in technology, changing faces in engineering, engineering education, the problem of outsourcing engineering jobs, the government's role in the profession, and engineering as a sound career choice are discussed by these leaders of industry.

Stereotypes and Perceptions of Engineering. Research about stereotypes and their impact upon girls was another important theme in scholarly research about why young women are less likely than their male counterparts to choose an engineering major. Gender stereotypes are ingrained into children at a very young age, which are then posited to affect girls' performance and participation in math and science. Heyman & Legare asked 60 kindergarten and first graders and 60 fourth and fifth graders questions to determine the extent to which they stereotyped activities by gender. They found that regardless of sex and age, children indicated that girls were better at spelling and reading and had more pro-social tendencies while boys were more aggressive (physical and relational). Significantly, children did not stereotype math or a host of other activities as gendered.

In 2004, there were several journal articles about stereotypes and stereotype threat and their effect on women and ethnic minorities in science (Ford, Ferguson, Brooks and Hagadone; Pronin, Steele, and Ross; Miller and Bichsel; Bell, Anderson-Cook and Spencer; Hannover and Kessels; Wilkins; Brascoll and LaFrance; Skaalvik and Skaalvik; Schmader, Johns, and Barquissau; Schottenbauer, Rodriguez, Glass, and Arnkoff). Unfortunately, most of these articles use convenience samples, which limit their generalizability. Nonetheless, several studies used larger sample-sizes and provided convincing results.

Wilkins (2004) studied the effects of stereotypes, self-concept, and performance at an international level using data from Third International Mathematics and Science Study (TIMSS) conducted by the International Association for the Evaluation of Educational Achievement. This international project involved over half a million students from more than 40 countries. Wilkins found that the participants' view of their performance was overall quite positive. Students with higher self-concept had greater achievement and students from higher achieving countries on average had lower self-concept. The findings suggested that cultural differences affected the students' self-concept and, therefore, achievement.

Skaalvik and Skaalvik (2004) examined 907 (487 females, 420 males) sixth, ninth, eleventh, and senior high school students' self-concept in math and verbal classes, performance expectations, and the motivation for high achievement. Male students had higher self-perceived abilities and motivation in mathematics whereas females had higher self-perceived abilities and motivation in language. Boys' higher math perceptions occurred as early as the end of elementary school.

What images of engineering are presented to young girls? To what extent will young girls be able to envision themselves as engineers? In a unique article, Steinke (2004) analyzed science and engineering Web sites targeted at girls to assess the information presented, how and in what style it was presented, and how female scientists and engineers are portrayed, feeling that these Web sites may be an important source of information on science, engineering, and technology (SET) for young girls. A total of 27 Web sites were studied and 168 biographies on female scientists and engineers were found. After coding themes from these Web sites, the author found a variety of organizations are responsible for these Web sites ranging from NASA to the Girl Scouts. They were aimed at girl audiences of all ages, and many contained information for parents and teachers. Many took on a more "hands-on" approach by encouraging girls to try experiments, participate in quizzes, message boards and other educational and interaction-based materials. Steinke found that these Web sites have the ability to increase girls' knowledge about SET, provide career information, and provide girls the opportunity to interact with professionals in these fields. However, the negative, though realistic, depictions of the challenges women face may dissuade talented girls from entering careers in SET.

Elgar (2004) performed a content-analysis of a recently published (1998-2000) series of textbooks entitled, *Lower Secondary Science for Brunei Darussalam*. Photographs and drawings were analyzed and categorized by who was depicted

in the picture: male only, female only, and both males and females. Photographs depicting males were four times as numerous as photographs depicting females only and there were six drawings of males for every one drawing of a female only. Women were not seen when the photographs or drawings were demonstrating scientific principles and procedures, but instead women were seen primarily to illustrate pregnancy, childcare, heredity, the five senses, and concern for the environment. There were only ten images of females demonstrating a scientific principle or procedure. Language was also analyzed to determine how often men and women were referred to in the text. The textbooks only mentioned eleven people by name, and nine of them were famous male scientists while none were female scientists. Male pronouns were six times more likely to be used than female pronouns in contexts not related to sexual physiology. In many instances masculine pronouns were used for all people, which would include females. The author concludes that since women are increasingly represented in the sciences, textbooks should be reoriented to reflect their representation and contributions.

Conclusion

We have used this article to provide a smattering of the literature that was published in the past year about women in engineering. Given space limitations, we were unable to provide full details about all of the literature that has appeared in the past year and encourage you to make use of our references to obtain articles that are of interest to you.

Bibliography

Adam, A., D. Howcroft, and Helen Richardson, "A Decade of Neglect: Reflecting on Gender and IS," *New Technology Work and Employment*, 19 (3), 2004: 222-240.

Ahuja, M., J. Robinson, S. Herring & C. Ogan, "Exploring Antecedents of Gender Equitable outcomes in IT Higher Education," *SIGMIS CPR 2004, Proceedings of the 2004 ACM SIGMIS CPR Conference*, April 22-24, 2004: 120-123.

____ *American Economic Review* "The underrepresentation of minority faculty in higher education: Panel discussion," 94 (2), 2004: 302-306.

Anderson-Rowland, M. & P. Johnson, "Encouraging Underrepresented Minority and Women Students to Become Interested in Research and to Attain Graduate Degrees," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 4669-4676.

Anderson-Rowland, M., M. Vanis, D. Banks, B. Mater, D. Zerby & E. Chain, "METS Pilot Program: A Community College / University Collaboration to Recruit Underrepresented Minority Students into Engineering," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 9741-9749.

Barlow, A. & M. Villarejo, "Making a Difference for Minorities: Evaluation of an Educational Enrichment Program," *Journal of Research in Science Teaching*, 41 (9), 2004: 861-881.

Bartindale, B. & K. McLaughlin, "Regents name new chancellor for UCSC," Mercury News Online, December 15, 2004.

Bell, A.E., C. Anderson-Cook, & S. Spencer, "Stereotype Threat in the Engineering Classroom," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 12897-12904.

Beoku-Betts, J., "African Women Pursuing Graduate Studies in the Sciences: Racism, Gender Bias, and Third World Marginality," *NWSA Journal*, 16 (1), 2004: 116-135.

Berscoll, V. & M. LaFrance, "The Correlates and Consequences of Newspaper Reports of Research on Sex Differences," *Psychological Science*, 15 (8), 2004: 515-520.

Bix, A.S., "From "Engineeresses" to "Girl Engineers" to "Good Engineers": A History of Women's U.S. Engineering Education," *NWSA Journal*, 16 (1), 2004: 27-49.

Boque, B. & M.E. Litzinger, "Wellness Strategies for Women Engineers: An Interdisciplinary Course Designed to Help Women Engineers Succeed," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 15433-15442.

Brown, A. R., "African-American Undergraduate Engineering Student Perceptions of The Campus Climate and Institutional Graduation Rates," Columbia University Teachers College, 2004.

Brown, B.A., "Discursive Identity: Assimilation into the Culture of Science and its Implications for Minority Students," *Journal of Research in Science Teaching*, 41 (8), 2004: 810-834.

Buck, J.L., "Gender Generalization: Female Integration Into Industrial Technology and Factors Contributing to Their Recruitment and Retention," Mississippi State University, 2004.

Bystydzienski, J.M., "(Re)Gendering Science Fields: Transforming Academic Science and Engineering," *NWSA Journal*, 16 (1), 2004: viii-xii.

Cano, R., B.H.N. Koppel, S. Gibbons & H. Kimmel, "Evaluation of Summer Enrichment Programs for Women Students," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 5361-5369.

Carter, L., "Thinking Differently About Cultural Diversity: Using Postcolonial Theory to (Re)Read Science Education," *Science Education*, 88, 2004: 819-836.

Carver, C., "Techniques for Supporting Diversity in a Freshman Information Technology Course," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 13941-13947.

Chesler, N. & D. Riley, "The Art of Engineering: Using Fine Arts to Discuss the Lives of Women Faculty in Engineering," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 599-610.

Choudhuri, E., "Sociocognitive Factors Influencing Undergraduate Women's Commitment to Their Choice of Engineering Majors," The University of Iowa, 2004.

Cole, S. & E. Barber, *Increasing Faculty Diversity: The Occupational Choices of High-Achieving Minority Students*. Cambridge, MA: Harvard, 2003.

Correll, S.J., "Constraints into Preferences: Gender, Status, and Emerging Career Aspirations," *American Sociological Review*, 69 (1), 2004: 93-113.

Crawford, M. & K. Schmidt, "AIM for Engineering: Lessons Learned from a K-12 Project," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 315-327.

Crowley, S., D. Fuller, W. Law, D. McKeon, J. Ramirez, K. Trujillo & E. Widerman, "Improving the Climate in Research and Scientific Environments for Members of Underrepresented Minorities," *The Neuroscientist*, 10 (1), 2004: 26-30.

Curry, B., "Female retention in undergraduate engineering majors: The effects of

individual characteristics, career characteristics, and demand," Colorado School of Mines, 2004.
Curtis, J.W., "Balancing Work and Family for Faculty: Why It's Important," *Academe*, 90 (6), 2004, http://www.aaup.org/publications/Academe/2004/04nd/04ndcurt.htm.
Demir, S., "Peer-Mentoring Among Female Biomedical Engineering Students Can be Extended to Other Engineering Disciplines," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 10983-10987.
Diefes-Dux, H., D. Follman, P. Imbrie, J. Zawojewski, B. Capobianco & M. Hjalmarson, "Model Eliciting Activities: An In-Class Approach to Improving Interest and Persistence of Women in Engineering," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 9841-9855.
Dockter, J., "E-Mentoring for Women Graduate Students in Engineering and Science," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 4157-4169.
Elgar, A.G, "Science Textbooksfor Lower Secondary Schools in Brunei: Issues of Gender Equity," *International Journal of Science Education*, 26 (7), 2004: 875-894.
Eschenbach, E. & E. Cashman, "Go with the Flow- A Student Leadership Opportunity Integrating K-12 Outreach, The Society of Women Engineers, Service Learning and Peer Mentoring," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 6197-6201.
Fadigan, K.A & P. Hammrich, "A Longitudinal Study of Educational and Career Trajectories of Female Participants of an Urban Informal Science Education Program, *Journal of Research in Science Teaching*, 41 (8), 2004: 835-860.
Finken, D.A., "Changing the World of Engineering, Policy by Policy," *SWE Magazine*, Fall, 2004: 14-18.
Ford, T.E., M. Ferguson, J. Brooks, & K. Hagadone, "Coping Sense of Humor Reduces Effects of Stereotype Threat on Women's Math Performance," *Personality and Social Psychology Bulletin*, 30 (5), 2004: 643-653.
Frehill, L.M., "The Gendered Construction of the Engineering Profession in the United States, 1893-1920," *Men and Masculinities*, 6 (1), 2004: 383-403.
_____. "Women of color in the engineering pipeline." *Proceedings: Women in Engineering Program Advocates Network Annual Conference*, Albuquerque, NM, 2004.
Frehill, L. M., C. Jeser-Cannavale & J. Benton-Speyer. Literature Review of Women in Engineering, 2003. *SWE Magazine*, Summer, 2004: 20-36.
Frehill, L. M., J. Benton-Speyer, & P. Hunt. Literature Review of Women in Engineering, 2002. *SWE Magazine*, Summer, 2003: 22-37.
Gibbons, M. "Tech Trends" *Prism (American Society for Engineering Education)*, January, 2005.
_____. "Doctorate Enrollment Up" *Prism (American Society for Engineering Education)*, October, 2004.
Ginther, D., "Why Women Earn Less: Economic Explanations for the Gender Salary Gap," *AWIS Magazine*, 33 (1), 2004:1-5.
Gordon, C. & B. L. Keyfitz, "Women in Academia: Are We Asking the Right Questions?" *Notices of the American Mathematical Society*, 51 (7), 2004: 784-786.
Gould, P., "The 3 Rs: Recruitment, Retention, Returning," *The Institute of Physics, The Daphne Jackson Trust, the Royal Academy of Engineering, the Engineering and Technology Board and the Science Council*, March 2004.
Grasso, D. "Engineering and the Human Spirit," *American Scientist*, 92 (3), 2004: 206-208.
Grasso, D., K.M. Callahan & S. Doucett, "Defining Engineering Thought," *International Journal of Engineering Education*, 20 (3), 2004: 412-415.
Grubbe, D., "Get Digital About Your Commitment! Commitment Keeps You in the Game," *AWIS Magazine*, 33 (3), 2004:16-19.
Hamilton, K., "Faculty Science Positions Continue to Elude Women of Color: Oklahoma Professor's Study Finds Hiring, Tenure Remain Stumbling Blocks," *Black Issues in Higher Education*, 21 (3), 2004: 36-39.
Hannover, B. & U. Kessels, "Self-to-Prototype Matching as a Strategy for Making Academic Choices. Why High School students do not like Math and Science," *Learning and Instruction*, 14 (1), 2004: 51-67.
Hanson, S.L., "African-American Women in Science: Experiences from High School through the Post-Secondary Years and Beyond," *NWSA Journal*, 16 (1), 2004: 96-115.
Harris, B.J., T.R. Rhoads, S.E. Walden, T.J. Murphy, R. Meissler & A. Reynolds, "Gender Equity in Industrial Engineering: A Pilot Study," *NWSA Journal*, 16 (1), 2004: 186-193.
Haupt, S.E. & J. Gregory, "Planning Approach for The Society of Women Engineers Mentoring Girl Scouts,"*ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 11073-11084.
Haynes, A.F., A. G. Mullins & B. S. Stein, "Differential Models for Math Anxiety in Male and Female College Students," *Sociological Spectrum*, 24 (3), 2004: 295-318.
Herzig, A.H., "Becoming Mathematicians: Women and Students of Color Choosing and Leaving Doctoral Mathematics," *Review of Educational Research*, 74 (2), 2004: 171-214.
____ "IBM Excite Camps Take Technology on Tour; 37 Week-Long Camps Give Girls Around the World a Chance to Explore Math, Science, and Technology Careers," *PR Newswire*, June 2, 2004.
Heyman, G.D. & C. H. Legare, "Children's Beliefs about Gender Differences in the Academic and Social Domains," *Sex Roles*, 50 (3-4), 2004: 227-239.
Jackson, J., "The Story is Not in the Numbers: Academic Socialization and Diversifying the Faculty," *NWSA Journal*, 16 (1), 2004: 172-185.
Jacobs, J. & S. Winslow, "The academic life course: Time pressures and gender inequality," *Community, Work, and Family* 7(2): 143-161, 2004.
Jeffers, A., A. Safferman & S. Safferman, "Understanding K-12 Engineering Outreach Programs," *Journal of Professional Issues in Engineering Education and Practice*, 130 (2), 2004: 95-108.
Klein, J., "Who is Most Responsible for Gender Differences in Scholastic Achievements: Pupils or Teachers?", *Educational Research*, 46 (2), 2004: 183-193.
Klopfenstein, K. "Advanced Placement: Do Minorities Have Equal Opportunity?" *Economics of Education Review*, 23 (2) 2004: 115-131.
Knight, M.T. & C. Cunningham, "Building a Structure of Support: An Inside Look at the Structure of Women in Engineering Programs," *Journal of Women and Minorities in Science and Engineering*, 10 (2), 2004: 1-20.
Kohlstedt, S.G., "Sustaining Gains: Reflections on Women in Science and Technology in 20th Century United States," *NWSA Journal*, 16 (1), 2004: 1-26.
Kuyath, S. & L. Yoder, "Diversity in Engineering Technology: Competitions," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 4017-4027.
Lawrey, A., S. Heyman & R. Rockland, "Engineering a Difference: Outreach Component,"*ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 4761-4768.
Layne, P., "Women in Engineering Leadership Summit," *SWE Magazine*, Fall, 2004: 34-36.

Layne, P., "Women and Engineering Leaders in Academe 2004", *SWE Magazine*, Fall 2004: 27-30.
Leuwerke, W.C., S. Robins, R. Sawyer, M. Hovland, "Predicting Engineering Major Status form Mathematics Achievement and Interest Congruence," *Journal of Career Assessment*, 23(2), 2004: 135-149.
Lips, H, "The Gender Gap in Possible Selves: Divergence of Academic Self-Views Among High School and University Students," *Sex Roles*, 50(5/6), 2004: 357-371.
Llewellyn, D., M. Usselman & M. Gaughan, "Alternate Pathways to Success," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 357-372.
Lobel, S., "Working Part Time After Tenure," *Academe*, 90 (6), 2004, http://www.aaup.org/publications/Academe/2004/04nd/04ndlobe.htm.
Losh, S. C., "Gender, Educational, and Occupational Digital Gaps: 1983-2002", *Social Science Computer Review*, 22 (2), 2004: 152-166.
Lowery, S. E., "Gender Equity Options in Science: Effect on attitudes and behaviors of college women," Arizona State University, 2004.
Ma, X. & J. Xu, "The Causal Ordering of Mathematics Anxiety and Mathematics Achievement: A Longitudinal Panel Analysis," *Journal of Adolescence*, Vol. 27, No. 2, 2004, pp. 165-179.
Maher, M., M. Ford & C. Thompson, "Degree Progress of Women Doctoral Students: Factors that Constrain, Facilitate, and Differentiate," *The Review of Higher Education*, 27 (3), 2004: 385-2004.
Malcolm, S.M., D. E. Chubin & J. K. Jesse, "Standing Our Ground: A Guidebook for STEM Educators in the Post-Michigan Era," *American Association for the Advancement of Science and the National Action Council for Minorities in Engineering*, 2004. (Available at http://www.aaas.org/standingourground/).
Mantani, M., "Mapping Race and Gender in the Academy: The Experiences of Women of Colour Faculty and Graduate Students in Britain, the US, and Canada," *Journal of Geography in Higher Education*, 28 (1), 2004: 91-99.
Mason, M.A. & M. Goulden, "Do Babies Matter (Part II)? Closing the Baby Gap" *Academe*, 90 (6), 2004, http://www.aaup.org/publications/Academe/2004/04nd/04ndmaso.htm.
_____. "Marriage and baby blues: redefining gender equity in the academy," *Annals of the American Academy of Political and Social Science 596*: 86-102.
Maton, K.I. & F. A. Hrabowski III, "Increasing the Number of African-American Phds in the Sciences and Engineering: A Strengths-Based Approach," *American Psychologist* 59 (6), 2004: 547-556.
Matthews, B, "Promoting Emotional Literacy, Equity and Interest in Science Lessos for 11-14 Year Olds; 'Improving Science and Emotional Development' Project," *International Journal of Science Education*, 26 (3), 2004: 281-308.
Miller, H. & J. Bichsel, "Anxiety, Working Memory, Gender and Math Performance," *Personality and Individual Differences*, 37 (3), 2004: 591-606.
Moody, J., *Faculty Diversity: Problems and Solutions*. New York, NY: RoutledgeFalmer, 2004a.
Moody, J., "Supporting Women and Minority Faculty," *ACADEME- Bulletin of the AAUP*, 90 (1), 2004b: 47-52.
Mraz, S.J., "75 Years of Changes in Engineering," *Machine Design*, February 19, 2004: 80-92.
Myers Jr., S.L. & C.S. Turner, "The Effects of PhD Supply on Minority Faculty Representation," *American Economic Review*, 94 (2), 2004: 296-301.
_____ "NACME: Thirty Years. Thousands of Stories," *SWE Magazine*, Winter 2004: 51-54.
National Center for Education Statistics. Trends in Educational Equity of Girls & Women: 2004. (NCES 2005-016). U.S. Department of Education, National Center for Education Statistics, Washington, DC: U.S. Government Printing Office.
National Science Foundation. *Women, Minorities, and Persons with Disabilities in Science and Engineering, 2003*, Arlington, VA: National Science Foundation, 2004.
Niemeier, D.A. & C. Gonzalez, "Breaking into the Guildmaster's Club: What We Know about Women Science and Engineering Department Chairs at AAU Universities," *NWSA Journal*, 16 (1), 2004: 157-171.
Patitu, C.I. & K.G. Hinton, "The Experiences of African-American Women Faculty and Administrators in Higher Education: Has Anything Changed?", *New Directions for Student Services*, 104, 2004: 79-93.
Pawley, A. L. "The feminist engineering classroom: Vision for future educational innovations," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition, "Engineering Education Researches New Heights,"* 2004: 5737-5745.
Phillips, B., "Women are Taking the Helm at Engineering Associations," *U.S. Black Engineer and Information Technology*, 27 (4), 2004: 54-55.
Preston, A.E., "Plugging the Leaks in the Scientific Workforce," *Issues in Science and Technology*, 20 (4), 2004: 69-74.
Pronin, E., C. Steele, & L. Ross, "Identity Bifurcation in Response to Stereotype Threat: Women and Mathematics," *Journal of Experimental Social Psychlogy*, 40 (2), 2004: 152-168.
Purdy, C. & R. Kane, "Achieving Diversity in Graduate Engineering Education-What are the Major Issues?", *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 149-153.
Quinn, K., S.E. Lange & S.G. Olswang, "Family-Friendly Policies and the Research University,"*Academe*, 90 (6), 2004, http:www.aaup.org/publications/Academe/2004/04nd/04ndquin.htm.
Rajala, S., L. Bottomley, E.A. Parry, J.D. Cohen, S.C. Grant, C.J. Thomas, T.M. Doxey, G. Perez, R. Collins & J.E. Spurlin, "The North Carolina State University Women in Science and Engineering Program: A Community for Living and Learning,"*ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 10447-10464.
Rapoport, A.I., J. T. Bentley & D. E. Wise, "Gender Differences in the Careers of Academic Scientists and Engineers," National Science Foundation, Division of Science Resources Statistics, 2004.
Reisberg, R., P. Leventman, K. Ziemer, S. Blaisdell, A. Swan & P. Wong, "4 Schools for Women in Engineering: Innovative Approaches to Increase Middle School Students Interest in STEM," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 37-46.
Reskin, B. & P. Roos. *Job Queues, Gender Queues: Explaining Women's Inroads into Male Occupations*. Philadelphia, PA: Temple University Press, 1990.
Reydman, G.B. "Celebrating National Hispanic Heritage Month," *SWE Magazine*, Fall 2004: 54.
Risken, Eve, et. al., 2004, "Mentoring for Academic Careers", Proceedings of the PAESMEM/Stanford School of Engineering Workshop, October 4, 2004. (Available online at http://paesmem.stanford.edu.)
Robinson, W.P. & E. Gillibrand, "Single-Sex Teaching and Achievement in Science," *International Journal of Science Education*, 26 (6) 2004: 659-675.
Rochefort, W., K. Levein, E. Ford & E. Momsen, "Everything I Know I Learned in Kindergarten: Examples of Synergisms Between K-12 Outreach and Recruitment

and Retention of Women and Minorities in Engineering," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 5399-5413.
Roldan, M., L. Soe & E.K. Yakura, "Perceptions of Chilly IT Organizational Contexts and their Effect on the Retention and Promotion of Women in IT," *SIGMIS CPR 2004, Proceedings of the 2004 ACM SIGMIS CPR Conference*, April 22-24, 2004: 108-113.
Rosser, S.V., "Using POWRE to ADVANCE: Institutional Barriers Identified by Women Scientists and Engineers," *NWSA Journal* 16 (1), 2004: 50-78.
Schmader, T., M. Johns, & M. Barquissau, "The Costs of Accepting Gender Differences: The Role of Stereotype Endorsement in Women's Experience in the Math Domain," *Sex Roles*, 50 (11/12), 2004: 835-850.
Schottenbauer, M. A., B.F. Rodriguez, C.R. Glass,& D.B. Arnkoff, "Computers, Anxiety, and Gender: An Analysis of Reactions to the Y2K Computer Problem," *Computers in Human Behavior*, 20 (1), 2004: 67-83.
Skaalvik, S. &E. M. Skallvik, "Gender Differences in Math and Verbal Self-Concept, Performance Expectations, and Motivation," *Sex Roles*, 50 (3/4), 2004:241-252.
Smith, D.G., "The Campus Diversity Initiative: Current Status, Anticipating the Future," Claremont Graduate University, Campus Diversity Initiative Evaluation Project, *Association of American Colleges and Universities*, 2004.
Smyth, F.L. & J. J. McArdle, "Ethnic and Gender Differences in Science Graduation at Selective Colleges with Implications for Admission Policy and College Choice," *Research in Higher Education*, 45 (4), 2004: 353-381.
Snyder, J. D., "Gender by ethnic equity issues as they pertain to success in science education," Arizona State University, 2004.
Steinke, J., "Science in Cyberspace: Science and Engineering World Wide Web Sites for Girls," *Public Understanding of Science*, 13 (1), 2004: 7-30.
Sukumaran, B., H. Hartman & D. Johnson, "How to Improve Enrollment of Women in Engineering: Lessons Learnt from the Developing World," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 6577-6584.
Sullivan, B., C. Hollenshead & G. Smith., "Developing and Implementing Work-Family Policies for Faculty," *Academe*, 90 (6), 2004, http://www.aaup.org/publications/Academe/2004/04nd/04ndsull.htm.
_____"Summer Institute at UH Will be Engineering a Brighter Future; SECME Paves the Way for Minorities, Women to Study Science, Engineering in College," *PR Newswire*, June 14, 2004.
Symonds, W.C., "A Breakthrough for MIT-And Science," Business Week Online, October 4, 2004.
Tapia, A. & L. Kvasny, "Recruitment is Never Enough: Retention of Women and Minorities in the IT Workplace," *SIGMIS CPR 2004, Proceedings of the 2004 ACM SIGMIS CPR Conference*, April 22-24, 2004: 84-91.
Thomas, C., "Different Countries, Different Cultures, Different Women = One World and One Purpose," *SWE Magazine*, Fall 2004: 38-44.
Trauth, E.M., J.L. Quesenberry & A.J. Morgan, "Understanding the Under Representation of Women in IT: Toward a Theory of Individual Difference," *SIGMIS CPR 2004, Proceedings of the 2004 ACM SIGMIS CPR Conference*, April 22-24, 2004: 114-119.
Urry, M. and N. Thompson, "The Marie Curie Nobel Centennial Symposium at Yale University: Celebrating Women in Science," *AWIS Magazine*, 33 (1), 2004:15-21.
Valian, V. "Beyond Gender Schemes: Improving the Advancement of Women in Academia," *NWSA Journal*, 16 (1), 2004: 207-220.
Voyles, M., A. Williams, "Gender Differences in Attributions and Behavior in a Technology Classroom," *Journal of Computers in Mathematics and Science Teaching*, 23 (3), 2004: 233-256.
Waller, A. "T-Shirts and Ponytails: Women Students in Engineering Talk about Self-Presentation," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 13291-13302.
Ward, K. & L. Wolf-Wendel, "Fear Factor: How Safe Is It to Make Time for Family?", *Academe*, 90 (6), 2004, http://www.aaup.org/publications/Academe/2004/04nd/04ndward.htm.
Ward, K. & L. Wolf-Wendel, "Academic Motherhood: Managing Complex Roles in Research Universities," *The Review of Higher Education*, 27 (2), 2004: 233-257,
Wasburn, M, "Is Your Classroom Woman-Friendly? Ten Strategies for Reaching this Goal," *College Teaching*, 52 (4), 2004: 156-158.
Washburn, M. & S. Miller, "Developing an Integrated Freshman Seminar for Women in Technology: An Innovative University-Corporate Partnership Model," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 3183-3191.
Watford, B. & S. Artis, "Hypatia: A Residential Program for Freshman Women in Engineering," *ASEE Annual Conference Proceedings, ASEE 2004 Annual Conference and Exposition*, 2004: 6651-6661.
Williams, J.C., "Hitting the Maternal Wall," *Academe*, 90 (6), 2004, http://www.aaup.org/publications/Academe/2004/04nd/04ndwill.htm.
Williams, J. "The Case for Women's Groups in the Technical/Professional Workplace", *SWE Magazine*, Spring 2004: 52-55.
Williams, W.M., P.B. Papierno, M.C. Makel, S.J. Ceci, "Thinking Like a Scientists About Real-World Problems: The Cornell Institute for Research on Children Science Education program," *Applied Developmental Psychology*, 25 (1), 2004: 107-126.
Wilkins, J.L.M, "Mathematics and Science Self-Concept: An International Investigation," *The Journal of Experimental Education*, 72 (4), 2004: 331-346.
Wilson, M, "A Conceptual Framework for Studying Gender in Information Systems Research," *Journal of Information Technology*, 19, 2004: 81-92.
Wraige, H., "No job for a woman?", *Professional Engineering*, 17 (9), May 19, 2004: 40.
Yund, M.A., "Changing the World: Anita Borg's Inspiring Example,",AWIS Magazine, 33 (1), 2004.

Lauren N. Ketcham, ADVANCE: Institutional Transformation Program, MSC 3AIT, Box 30001, Las Cruces, NM 88003, laurenk@nmsu.edu.

Lisa M. Frehill, ADVANCE: Institutional Transformation Program, MSC 3AIT, Box 30001, Las Cruces, NM 88003, lfrehill@nmsu.edu, http://www.nmsu.edu/~advprog.

Cecily Jeser-Cannavale, ADVANCE: Institutional Transformation Program, MSC 3AIT, Box 30001, Las Cruces, NM 88003, cjeser@nmsu.edu.

This research was supported by a grant from the National Science Foundation ADVANCE: Institutional Transformation Program, NSF #0123690. The views expressed are those of the authors and do not reflect those of the National Science Foundation. ■

The "SWE 2004 Literature Review" originally appeared in the Summer 2005 issue of SWE Magazine Volume 51, Number 3, copyright 2005

Society of Women Engineers

ASPIRE • ADVANCE • ACHIEVE

The Society of Women Engineers (SWE), founded in 1950, is a not-for-profit educational and service organization. SWE is the driving force that establishes engineering as a highly desirable career aspiration for women. SWE empowers women to succeed and advance in those aspirations and be recognized for their life-changing contributions and achievements as women engineers and leaders.

The Society of Women Engineers
230 E. Ohio St., Suite 400 • Chicago, IL 60611
(312) 596-5223 • FAX (312) 644-8557
Web Site: www.swe.org