A REPORT OF THE NEW JERSEY STATE EMPLOYMENT AND TRAINING COMMISSION
COUNCIL ON GENDER PARITY IN LABOR AND EDUCATION

Engage, Inspire, Connect, and Collaborate

6th Annual New Jersey Women in

Science and Technology Workforce Summit

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New Jersey's Council on Gender Parity

Established within the State Employment and Training Commission (SETC), the New Jersey Council on Gender Parity in Labor and Education is the only one of its kind in the United States created by legislation to address issues of gender disparity in labor and education. Beginning with its first meeting over a decade ago, the Council has provided the State with leadership on gender equity issues important to economic and workforce development. The appropriation for the Gender Parity Council also funds gender equity experts to work directly with State Departments to assist them in the implementation of policies and programs in gender-conscious ways. This is a unique role that does not exist in any other form in our state government. Through these and other initiatives, the New Jersey Council on Gender Parity in Labor and Education has made tremendous strides in the advancement of equity in the State.

Overview

Since its 2000 inception, the Council on Gender Parity in Labor and Education has worked to address gender disparities in New Jersey's science and technology workforce. Through numerous outlets, including the five previous New Jersey Women in Science and Technology Workforce Summits and original, published research, the Council has contributed insight into women's historic and continued underrepresentation in Science, Technology, Engineering, and Mathematics (STEM) fields. The 2012 Summit took place in the 41st consecutive month with a U.S. unemployment rate exceeding 8 percent[1] (Bureau of Labor Statistics [BLS], 2012a) and the 39th consecutive month with a New Jersey unemployment rate exceeding 9 percent (New Jersey Department of Labor and Workforce Development [NJ LWD], 2012a). In this troubling economic context, eliminating gender-based barriers to academic and career success takes on an even greater importance. Thus, the Council continues its focus on STEM in an effort to raise awareness, broaden public dialogue, and develop effective policies to address gender inequity in education, recruitment, retention, and advancement in this important sector of New Jersey's economy.

While the 2010 and 2011 Summits were designed to respond to the challenging labor market conditions associated with an economic recession, the 2012 Summit positioned itself to take advantage of recovery trends, including the steady growth of private sector jobs in New Jersey and nationally, as well as a well-established interest in the development of public-private and academic-industry partnerships. Concerted efforts were made to bring to the table leading voices from business and industry, higher education, the non-profit sector, the research community, and the public sector to raise awareness of model collaborations and to build energy around innovative ideas for bringing STEM knowledge and sustainable STEM careers to promising individuals regardless of gender.

One of the key recommendations to emerge from the 2011 Summit was that New Jersey work to develop vibrant and sustainable partnerships between community colleges, other institutions of higher education, state and local government, and industry, with a continued focus on linking curricula and public programs to industry needs. To address this recommendation, the 2012 Summit was organized around the theme, *Engage, Inspire, Connect, and Collaborate*.

The 2012 *New Jersey Women in Science and Technology Workforce Summit* was well-positioned to address concerns at an individual level and to turn the combined expertise, wisdom, and experience of women and men in STEM fields into practice and policy recommendations. The format for the 2012 Summit followed a multi-year history, beginning in 2007. Each year since

[1] Unemployment rates reported here are seasonally adjusted for those age 16 and older.

then, the Council brought together a diverse group of stakeholders to share perspectives, and develop comprehensive and integrated recommendations for addressing gender issues in STEM education and employment.

Multiple local, state, and nation-wide recommendations have emerged over the course of the preceding five Summits. Findings and recommendations are detailed in five *Annual Women in New Jersey's Science and Technology Workforce Summit* reports, archived at www.njsetc.net (2007, 2008, 2009, 2010, and 2011). To frame this sixth *Annual Report*, a list of recommendations from the fifth Summit is provided. As noted above, it is the fourth in this set of recommendations ("Across the Pipeline") that provided the impetus for the sixth annual Summit and this Summit report:

I. *Elementary and secondary education*

a. Build science and mathematics education programs that…
    i. Reinforce effort and risk-taking rather than accomplishment
    ii. Reward growth and learning rather than performance
    iii. Apply learning to real-life problems and needs
    iv. Incorporate a substantial "hands-on" component
    v. Are interdisciplinary
b. Examine the role of high school guidance counselor; ensure that this role is designed and adequately supported to offer a full range of opportunities to young women and men
c. Expose students to women who are successful in STEM fields
d. Develop performance standards that are clear and consistently applied
e. Expose students to available jobs and careers beyond the female-stereotyped options, such as nursing and physical therapy

II. *Higher education*

a. Accelerate and spread the development of professional science master's education that…
    i. has deep knowledge of science
    ii. is interdisciplinary
    iii. strongly emphasizes effective communication and problem solving
    iv. provides an understanding of entrepreneurial skills and technical innovation
b. Connect women in STEM majors to resources, advising, mentoring, and support, that will follow them throughout their college years
c. Connect learning, both in the classroom and in affinity groups, with real-world problems and real-world efforts to generate solutions

III. *Profession/career*

a. Develop standards for a "diversity-friendly" company and recognize excellence in valuing and managing diversity
b. Develop policies intended to improve retention and advancement in STEM careers by addressing the full context of contemporary family life (e.g. child care supports, paid family and medical leave)
c. Develop volunteering programs for those just starting in their careers or facing transitions; provide visibility and recognition of the idea that volunteering builds skills
d. Develop and support programs such as *Crucial Conversations* (p. 19, http://www.vitalsmarts.com/crucialconversationstraining.aspx) that teaches communication skills to employees, and focuses on how to talk about one's views, how to present different ideas, and how to manage conflict.

IV. *Across the pipeline*

a. Disseminate information at all educational and professional levels about ongoing programs and activities for girls and women in STEM
b. Develop vibrant and sustainable partnerships between community colleges, other institutions of higher education, state and local government, and industry
c. Create clear performance standards, with an eye toward making sure that standards are not skewed toward "what men are already doing"
d. Develop and support forums for women; women in general, but especially those in non-traditional fields, benefit from a "space" in which they can become role models for up-and-coming women in their field, recognize one another for their unique accomplishments, and support one another in workplace and academic settings

Over the past year, the New Jersey State Employment and Training Commission, the Council on Gender Parity in Labor and Education, and the Science and Technology Workforce Committee have responded to the 2011 recommendations in a number of ways. The SETC has formed six *Talent Networks,* comprised of industry representatives, academic institutions, organized labor, community groups, and state and local government representatives, and has charged each with planning innovative and flexible responses to the training, employment, and advancement needs in their particular sector. These sectors include Transportation, Logistics, and Distribution; Financial Services; Health Care; Technology and Entrepreneurship; Advanced Manufacturing; and Life Sciences. According to the New Jersey Department of Labor and Workforce Development, more than half of the State's workers are employed in these six

industry sectors, which together account for two-thirds of all wages paid in the State. To varying degrees, each of these sectors includes STEM occupations.

The *LinkedIn* site developed during the planning of the 2010 Summit continues to address several of the recommendations noted above, by providing a social media platform for networking, raising awareness of technical and political developments, connecting individual mentors and mentees, and forming mentoring groups.

The Audience

On June 15th, 2012, representatives from industry, K-12 schools, academia, government and community-based organizations gathered at the Conference Center at Mercer in West Windsor, New Jersey, for the Gender Parity Council's *New Jersey Women in Science and Technology Workforce Summit*. The Summit would not have been possible without the generous time, support, and effort of its committee members (*pages []*), who represent a variety of organizations concerned with assisting women in developing their careers, increasing women's participation in the STEM workforce, and preparing a skilled, educated, resilient, and innovative 21st century workforce.

More than 260 people attended this year's Summit, including scientists; business and industry representatives; teachers, administrators, and students from high schools, community colleges and universities; consultants; non-profit organization representatives; and representatives from federal, state and local government agencies.

The audience for the 2012 Summit was well-equipped to fulfill the theme of the day: to engage, inspire, connect, and collaborate. Participants continued to identify with the 2011 image of a pipeline which has both critical junctures, particularly as individuals move from interest to education and from education to career and from early career to mid-career, and gaps. All along the way, but particularly at these junctures, we lose women. The goal for 2012 in particular was to generate ideas for actionable solutions and build sustainable collaborations. Thus, the program and policy recommendations generated during the course of the day and presented herein are noteworthy for the extent to which they reflect the combined and collaborative expertise of presenters and audience members.

Setting the Stage

The Summit opened with a formal welcome and introduction from Dianne Mills McKay, Chair of the Gender Parity Council, and from Grace Protos, Regional Administrator, U.S. Department of Labor (DOL) Women's Bureau. After describing the unique set of roles played by New Jersey's Gender Parity Council, Ms. McKay posed two key questions: first, how do we interest more girls in STEM careers? And, second, in college and later career, how do we attract and retain more talent? She encouraged both presenters and audience members to be attentive to the need for actionable solutions to the familiar problem of gender disparity in STEM representation.

Grace Protos described the U.S. DOL's Women's Bureau as an agency designed to safeguard the interests of women and their families, working primarily through collaboration with public and private organizations across the United States. She then highlighted four current areas of focus for the Women's Bureau.

- Workplace flexibility: Following up on public forums held on a variety of workplace flexibility topics (both differing sectors such as manufacturing and entrepreneurship, and differing workforces such as low-wage and high-wage), the Women's Bureau has published a summary and guide that is available online (http://www.dol.gov/wb/media/NDWFreports_and_pubs.htm).
- Equal pay: The Women's Bureau offers resources for employers and women.
- Female veterans: The Women's Bureau has made available a trauma-informed care guide (http://www.dol.gov/wb/trauma/WBTraumaGuide2011.pdf).
- Green jobs: The Women's Bureau has produced a guide for women called *Green Jobs Why Green Is Your Color*, available at (http://www.dol.gov/wb/Green_Jobs_Guide/GreenJobs%20Final_11.2011.pdf).

Following Ms. Protos' welcome, Jeff Stoller, Assistant Commissioner, New Jersey Department of Labor and Workforce Development, presented current data on the under-representation of women in STEM careers in New Jersey. He identified four obstacles faced by women in STEM careers: lack of mentorship, extreme work schedules versus work-family balance, unclear rules on advancement, and lack of visible female role models in STEM. Mr. Stoller reported that, among New Jerseyans with STEM degrees, 1 of every 10 men and 1 of every 4 women is unemployed or employed in another field. This striking difference illustrates the importance of creating conditions that not just get women into STEM careers but keep them there.

Keynote Speaker

Dr. Helen Berman, a renowned crystallographer and Board of Governors Professor of Chemistry and Chemical Biology at Rutgers University, gave the keynote address. She traced her career path, paying particular attention to sources both of challenge and of encouragement. Dr. Berman identified several lessons applicable to women interested in STEM careers: find mentors, both women and men; find a passion or at least a strong interest; explore concrete, meaningful opportunities; pursue collaboration; and become a mentor. She noted that businesses should reward employee-mentors. Dr. Berman also advised that we all need to take young people – their concerns and their passions seriously.

Moderated Panel – Where We Are and Where We Are Going

Dr. Berman's presentation was followed by a facilitated panel, which included Dr. David Finegold, Senior Vice President, Rutgers, The State University of New Jersey; Vicki Gaddy, Director, BioNJ Life Sciences Talent Network; Kristin Graf, Executive Director, Women of Wind Energy; Sarah Hospodor-Pallone, Deputy Associate Administrator, U.S. Environmental Protection Agency; and Dr. Gale Tenen Spak, Associate Vice President, New Jersey Institute of Technology (NJIT). The panel covered a range of topics based primarily on questions from the audience, presented below along with a summary of responses.

How do we get "there"?

New Jersey has tremendous talent but may not be connecting its talent most productively. The newly created Life Sciences Talent Network aims to correct this by working to "connect the dots" in life sciences, one of the largest and most dominant workforce sectors in New Jersey. The goal is to create the shortest distance between real jobs and real talent. This talent network, like the five others operating in New Jersey, will support candidates in networking, marketing themselves, and pursuing career flexibility. Another practical way to nurture and connect talent to New Jersey industry needs can be found in Rutgers' "Maker or Hacker" spaces, which provide space and tools (e.g., sodering equipment, 3D imaging, lasers) for use by displaced workers and young people looking to learn new skills and demonstrate and refine existing skills.

Panel members indicated that we need to work at individual (mentorship, sponsorship), cultural (workplace), and societal levels to bring more talented youth - both women and men - into STEM careers. Middle school may not be early enough to start. Gail Tenan Spak of NJIT confirmed this; she noted that only 7 percent of New Jersey high school graduates have enough math credits for admission to NJIT.

Young women tend to seek careers that are socially meaningful, suggesting that connecting public policy and social goods to science may have the potential to enhance interest. Kristin Graf recommended that students be given opportunities to shadow engineers; this would help them to understand concretely what engineers do.

How can older women transition into STEM?

Panelists generated the following recommendations for older women wishing to transition into STEM careers:

- Complete courses that can be layered on top of experience and credentials
- Seek out a prior learning assessment and stackable credentials
- Consider transferrable skills that you wish to continue using
- Market yourself to non-profits and early stage start-ups
- Focus on getting your "toe in the door" which may require career flexibility and building your reputation
- Use the following resources:
    - Talent Networks (www.BioNJTalentNetwork.org)
    - Jobs4Jersey (http://jobs4jersey.com/)
    - Massive open online courses (MOOCs)
    - LinkedIn
    - Local and professional organizations, such as the Association for Women in Science, Healthcare Businesswomen's Association (HBA), ChemPharma, and the American Chemical Society

What important traits and talents do you think women in particular bring to the STEM industries?

One panelist noted that, broadly speaking (this is not true of all women – and does include many men as well), women tend to bring a commitment to the bigger picture and using STEM skill sets to make the world a better place. Often they also bring a more collaborative leadership style and offer skills in social perceptiveness that are key to combating "group think". Each woman also brings her own unique background and perceptions to the table.

What would you do to get racial and ethnic minorities into STEM?

The panel recommendation was concise and strong: start young and early. The media may provide opportunities to show role models. It is also important to connect with more minority professionals in the industry. There is a very strong African American networking group called the Get-Together Pharma Group, through which there are some excellent mentors for students.

Boston has had amazing success in getting biotech/biopharma startups off the ground. What is NJ doing to try to replicate that success here?

According to one panelist, the State does offer some valuable incentives for companies to consider New Jersey as a place to plant their roots. The inception of the New Jersey Life Sciences Talent Network provides one of the top three key requirements for any business: capital, facilities and equipment, and *talent*. Our focus on local, industry talent offers a resource to businesses to help them get established and connected quickly.

New Jersey has a large contingency of professionals who are knowledgeable about the full process, from discovery to commercialization. The State is seeing a great deal of hiring in small to mid-sized employers, and large pharmaceutical companies are continuing to hire for certain specialties.

Panelists recommended that professionals keep in mind that not all jobs are posted on websites. Job seekers need to actively make connections across the industry in order to keep their fingers on the pulse of where opportunities lie. Others will literally create their own jobs by promoting their specialties through networking and staying in touch with industry news and the growth of local employers. Panelists also recommended that job seekers consider offering advice and insight pro-bono to get visibility and connect with the incubators where there are some very exciting early-stage businesses.

How can salaries and incentives be increased for science careers?

Compensation in the pharma/biotech industries is among the highest in the State. However, students are driven not only by salary. The current generation in school and recently graduated seems highly in tune with concerns about work/life and are regularly choosing slight decreases in pay for careers that they feel are better aligned with their own picture of what a fulfilled life looks like and how much they are required to put in for the financial gain that they get out. One panelist suggested that the question for science careers is actually a broad one of balance and overall financial benefit. There is an important culture concern within STEM fields – for example, expectations that your research will come before all else, respect for those in the lab at all hours, and the "publish or perish" axiom – that may play a much more pivotal role in career decision-making than pure salary.

What age/stage is the most critical for women to start having a mentor?

Panel members were in agreement that there is no absolute "most critical" stage, or at least no one stage that fits every person. One panelist noted that a mentor can be a great resource anytime a person is facing a transition or hoping to grow in a current position…or "all of our lives."

Are "paid mentors" useful for individuals looking to formalize mentoring and ensure that it happens? Do you consider this a good investment?

One panelist noted that a paid career coach or life coach is an investment best made when an individual has the time and energy both to make sure that he or she is matched well with the coach and to put his or her own effort into getting the most out of the relationship. This can be particularly helpful if someone wants to go deeply into a particular area or work intensely over a shorter period of time. In such circumstances, an individual voluntary mentor may not be able to provide the time and resources needed to achieve these goals.

What roles should alumni/alumnae of institutions of higher learning play in promoting retention of women graduates in STEM?

Panelists identified the following roles for alumni/alumnae:

- To be a role model of success in the field
- To mentor students considering going into their field
- To offer shadow days or internships to students interested in exploring the field
- To advocate for policies that support and promote women in STEM throughout the institution
- To give feedback particularly on their own experience at that institution and how it could be improved

Once women start their STEM careers, how can we get them to stay?

There was an important article in the Harvard Business Review in June 2008 called "Stopping the Exodus of Women in Science" by Sylvia Ann Hewlett, Carolyn Buck Luce, and Lisa J. Servon. They reported that "on the lower rungs of corporate career ladders, fully 41% of highly qualified scientists, engineers, and technologists are women. But the dropout rates are huge: Over time 52% of these talented women quit their jobs."

Most of this loss happens when women are in their mid-thirties. They identified the primary causes of this exodus in order to consider how we may be able to intervene to prevent losses from the pipeline:

- Hostility of the workplace culture
- Dispiriting sense of isolation
- Disconnect between preferred work rhythms and diving-catch/fire-fighting style that is usually rewarded
- Extremely long work weeks and punishing travel schedules

- Mystery around career advancement, inability to discern the pathway for career progress

Breakout Sessions

The Summit included four breakout sessions, each held once in the morning and once in the afternoon, during which participants engaged topics in detail. Each session was facilitated by professionals with expertise in specific topic areas, who served jointly as discussants and resources. Because sessions were designed to encourage an exchange of ideas and information between facilitators and attendees, each session took on a distinct direction and focus, while addressing several STEM-related issues.

Curriculum: STEM for All

Discussants: *Charlotte Gray (Session Chair), Education Program Development Specialist, NJ Department of Education; Kristin Germinario, Teacher of Biological Science, Randolph High School; Alison Goeke, Director, CTEP, Center for Excellence in STEM, The College of New Jersey; Jacqueline Lipper, Teacher/Mentor, DeVry University; and Carolyn Malstrom, Director of Biomedical Sciences Curriculum, Project Lead the Way*

In this session, attendees covered a range of curricular issues including experiential learning, teachers/mentors, curricular resources, diversity in STEM pathways, marketing STEM, and student to student mentorship.

Experiential Learning

Memorizing content will always be an important component of STEM education, but there is increasing recognition that content knowledge must be balanced with the development and application of skills that can be generalized. Overall, schools should develop more experiential learning components both in and out of the classroom. Research suggests that many women and girls are motivated by helping others so if coursework can focus on change and the person as an agent of change, it may be appealing for girls (e.g., cure cancer, find sustainable energy solutions).

One attendee noted that the Jersey City Public Schools have gone in the direction of project-led programs with great success. Students are seeing the applications of the content. For instance, teachers are not simply defining the slope of a line; they and the students are creating it. They are developing labs and projects for each content area. One attendee suggested that students should have access to lab work prior to sixth grade.

Tinkering stations can provide hands-on opportunities from an early age. Session attendees also recommended using group or partnered work, teaching basic research skills, and exploring programs such as BioBus (http://biobus.org/) and Students2Science (https://www.students2science.org/).

Teacher/Mentors

There is a pressing need for more teachers who are mentors in the classroom. Students need a safe classroom environment, one where they can be themselves and not be afraid to ask a question. Having a real passion for science (or math) really shows in teaching. Teachers mentor effectively when they engage students in the actual process, in developing and carrying out scientific inquiries.

Session attendees identified teacher preparation as another important issue needing input from NJ DOE and Higher Education. Elementary teachers have a difficult job, but they are not prepared in science. One attendee stated that fifth graders receive, on average, only 30 minutes a week of science instruction.

Another attendee emphasized the importance of cross-disciplinary work. A science teacher in attendance noted that subjects can be intertwined just as they are in the real world; for example, a school can teach math in English by teaching integrally.

The group suggested that implementing an integrated curriculum will require hiring the "right types of teachers" and supporting them with professional development. It is also important to make sure that science and mathematics teachers, both men and women, understand the female student. Teachers should also strive to make connections with students with whom they do not have a lot in common. Teacher preparation needs to incorporate instruction on the impact of presentation and non-verbal cues.

Faculty teachers, mentor teachers, and teachers from different departments can collaborate in the use of best practices and can observe other classrooms to suggest improvements. Ms. Germinario has a Knowles Science Fellowship, which supports science teachers in their first five years. Teachers should try to promote career readiness in their classrooms.

The Career Equity Resource Center (CERC) offers professional development for teachers and administrators at the middle and high school levels.

Curricular Resources

Project Lead the Way (PLTW) focuses on curriculum, professional development, and an extensive network. The PLTW curriculum is designed to be integrated into middle and high school courses and is both hands-on and standards-based. The National Alliance for Partnership

in Equity (NAPE) reviewed the PLTW curriculum to ensure that it was gender equitable. There are 80 hours of core training for educators associated with PLTW. The high school program is a full year of courses in either the science or technology departments. In the middle school, level units are integrated into school in 10-week units (http://www.pltw.org/).

The Center for Excellence in STEM at The College of New Jersey fosters K-12 STEM education. It is supported by multiple grant funds: National Science Foundation (NSF), U.S. Department of Education, and NJ Department of Education (NJ DOE). The first grant, Children Designing and Engineering, was a K-5 program which evolved into the Future Engineers of Trenton, a middle school program primarily in the Boys and Girls Clubs of America in Trenton. The Technology Student Association is funded by the NJ DOE. The Center of Excellence has a Career and Technical Education Partnership Grant to develop model programs of study in STEM. There are two tracks: science and math and engineering and technology. The hope is that the new engineering and technology modules will positively influence girls' participation and enrollment. The Center also has professional development all year, especially on integrated education (http://centerforstem.pages.tcnj.edu/).

The American Chemical Society has Chemistry Ambassadors who do experiments and teach others about STEM, while using language familiar to a broad audience (http://portal.acs.org/portal/acs/corg/content). The group recommended other programs including BioBus (http://biobus.org/) and Students2Science (https://www.students2science.org/) which has an excellent student to professional ratio.

Diversity in STEM Pathways

Session attendees tackled the challenging issue of making STEM relevant for students who have historically struggled in math and the sciences, particularly students from households with low income and/or low levels of formal education. Panelists suggested that it is important for students to understand how STEM careers can, quite literally, put food on the table. It is also important for students to understand that not all STEM jobs require four-year college degrees.

Unfortunately, many students become stuck in remedial courses in high school. They complete their required three years of math education and emerge knowing very little. Too many students are being told too young not to take courses in math and science because these courses are too difficult. Then, when they arrive at college, they need multiple non-credit basic courses to "catch up" with their peers. Given that many students are coming out of high schools without sufficient preparation to enter career courses in their first years of college, a key issue is how to keep their interest while they complete basic skills math or science courses in order to get to the level where they need to be to move forward. Because many students need to get

their degrees within two years for financial or other reasons, they give up on a STEM degree and opt for a liberal arts degree.

Teresa Boyer from the Center for Women and Work at Rutgers University discussed ways that Career and Technical Education (CTE) can overcome the divide between traditional math and science education and a meaningful career in math and science. She noted that women and girls approach their education holistically. While we have been successful at getting girls to take a single class, it is more difficult to make the connection from the class to the "table."

Intervention must take place at the middle and high school level. Students must be told about the importance of math and encouraged to stick with these courses even if they struggle initially. This will require investing in more comprehensive supports for those who struggle early.

One attendee emphasized the importance of a concrete invitation to make girls feel more comfortable with entering the STEM field. Girls may feel that they are "not allowed or good enough." So the invitation brings them in. This attendee noted that, in order to get girls involved in science and technology, her school runs a week-long program using money fundraised by private donors and grants. It is challenging to sustain the program financially.

Marketing STEM

Session attendees developed a number of suggestions for marketing STEM, particularly to young women. One noted that the STEM terminology may turn students and/or their parents away. STEM has to be attractive, which may mean bringing in role models and examples of work that seem "cool" and relevant.

Another way to market STEM is by connecting with information education agencies external to the school system, such as the Girl Scouts. Afterschool programs have been shown to affect science retention. The recent Girl Scout science report indicates that girls in STEM either knew someone in STEM, had a parent in STEM, or participated in some afterschool activity or spent time at museums.

One attendee wondered whether there an advantage to having a girls-only section for early STEM courses. Brooklyn Tech is conducting social action research into all-girls sections of engineering introduction. There is some evidence that girls placed in all-girls sections tend to persist in taking higher levels of STEM classes. Girls' perceptions of their academic proficiency are based in their abilities and performance, yet they consistently overestimate the math levels they need to achieve for success in STEM fields.

Student to Student Mentorship

Peer mentorship can be particularly powerful in young women's education. Students can communicate to one another that they are needed to solve the problems that they perceive and that they have a unique voice.

STEM Entrepreneurship: Inspiring Tomorrow's Leaders to Forge Their Own Path

Discussants: *Barbara Bosha (Session Chair), Owner, Bosha Design + Communications; Karen Noe, PMP, Technology Development and Transfer Consultant, Public Service Electric and Gas Company (PSE&G); Leslie Segal, President, Testware Inc.; and Linda Sharkus, Ph.D., Co-Founder and President, AcquiSci Inc.*

This panel session was designed for entrepreneurs, though, as panelists noted, whether selling a new idea or promoting ourselves, we are all entrepreneurs.

The panelists generated a list of qualities and skills useful for entrepreneurship:

- flexibility
- public speaking skills
- positive attitude
- skills in evaluating people as potential employees
- people management skills
- knowledge of finance and cash flow
- ability to implement, to put a plan into action
- emotional intelligence, understanding, and empathy
- persistence at networking and at self-marketing
- skills in negotiation
- skills in conflict resolution

They also came up with the following pieces of advice:

- Initially, investors tend to be drawn to people rather than ideas alone; therefore, branding and perception are very important.
- Entrepreneurs must learn how to be okay with failure and understand what failure can teach.
- One way to stay motivated is to do something unrelated to the business that provides a sense of accomplishment.

- Entrepreneurs may benefit from participating on a business advisory board to enhance their network and thereby expand access to funding and other resources.
- Throughout the life of a business, it is important to continually assess the skills your team has and to hire people who can strengthen weak areas.
- Fear can be motivating; when an entrepreneur takes on employees, she feels responsible for making sure they all get their salaries.
- It is valuable to connect with people not only to find work, but also to offer to do things for them; find out what people need and connect them with other people or help them yourself.
- Some women-owned businesses are a direct result of exclusion experienced in male-dominated professions; women business owners can be instrumental in introducing young women to entrepreneurial skills and opportunities.

Mastering Mentoring: Understanding a High-Impact Practice for Women in STEM

Discussants**:** *Elaine Zundl, MA (Session Chair), Assistant Dean, Douglas Residential College, Rutgers University; Jeanette Brown, Author,* African American Women Chemists*; Amber Charlebois, Ph.D., Associate Professor, Department of Chemistry and Pharmaceutical Science, Fairleigh Dickinson University; Kami Modi, Ph.D., Research and Outreach Analyst, Girl Scout Research Institute, Girl Scouts of the USA; and Barbara Schwartz, Ph.D., Senior Vice President, Morgan Wallace Associates*

The Mentoring Role

Mentoring can introduce young women to the process of tinkering, failing, and trying again and can show them that every problem has multiple solutions. Mentoring is about building confidence, competence, and commitment to a more intense, content-detailed education than in the humanities. Mentors can demonstrate for young women how to market themselves professionally.

The mentoring role can range from a long-standing, intensive commitment to a short-term, task-driven or goal-based one. One panelist noted that simply participating in Career Days so that students understand what various STEM professions entail can be a start to mentoring. The North Jersey section of the American Chemical Society does street fairs to talk to young girls about science careers. Social media tools like Facebook can make it easier than ever to maintain mentoring relationships across distance.

Women may also benefit from diversity in mentoring, not just by gender, race/ethnicity, or area of expertise but also by caregiving role. One panelist shared that, as a professor and mother of three young children, she models ways to juggle the two main areas of her life. She brings her children to class when they cannot go to school and hires a student to babysit when she is lecturing. Dr. Charlebois has started a business, Doctor Demo (http://drdemonj.com/drdemo_home.html), through which she introduces children to science and integrates the parent/scientist roles.

Mentoring in the Home, At School, After School, and in the Workplace

Session attendees discussed the range of environments in which mentoring can occur, along with strategies for strengthening each environment.

One panelist shared that her father was the only person who encouraged her to consider engineering; teachers and guidance counselors were discouraging. Indeed, audience members agreed that having a parent who is interested in STEM is a key factor in girls' choice of a STEM career. However, those in attendance agreed that because parents-as-STEM-mentors will not happen across the board, formal mentoring should be in the schools. Schools and other organizations could help bolster the parent role by providing math/science exploration programs for parents so that they are not afraid of these subjects, a fear that can be passed on to their children.

Session attendees agreed that training in mentorship should be a part of teacher education programs, beginning in elementary school. When children are young, they should be presented with a truly open field of possibilities in terms of studies and careers. One panelist recommended a series of programs run by the American Chemical Society, the Hach programs for high school chemistry teachers (www.acs.org).

Session attendees also identified the value of extracurricular and afterschool opportunities to be exposed to science-related activities and to mentorship. The Liberty Science Center has community nights to which urban school districts reportedly come in droves. This highlights the need for more afterschool programs. There could also be peer mentoring in school (for example, middle school students mentoring younger ones).

There is ample evidence of the importance of mentoring at the college level. A study of undergraduate students and leadership at Princeton University found that women identified support from a faculty member as a critical factor in their decision to apply for competitive STEM majors. At Mt. Holyoke College, which "has a long tradition of educating women chemists and is the alma mater of more Ph.D. women chemists than any other institution in the

country," the orientation details the pros and cons of attending an all-female college. One of the very strong pros that has been recognized over the years is the leadership strength that develops in female students during their time at Mt Holyoke. The school speculates that, without men to step forward, the young women must learn to take on all of the leadership roles in the school, thereby gaining both the skills and the confidence to do so. "One quarter of students here major in the sciences or mathematics, twice the number of women majoring in these areas at comparable coeducational institutions" (https://www.mtholyoke.edu/acad/chemistry/).

Of course, not all students will use STEM skills in typical ways. One panelist shared that her daughter uses her love of science to be a pastry chef. Session attendees identified the value of using aptitude career development in high school to help students to think about the range of options available to them. Internships and apprenticeship are extremely valuable ways to see if you like a field before committing to it.

Lastly, the session recommended that businesses would benefit from training managers in the mentoring role. Employees who mentor others are investing in productivity and retention and are raising the company's profile in the community. Session attendees made the case that mentoring should be incentivized and rewarded in the workplace. In academia, mentoring could become part of tenure consideration and, in other fields, part of promotion criteria.

Race, Socioeconomic Status, and STEM

When neither parents nor teachers are presenting STEM careers as viable options, it becomes far more difficult to get children involved. Positive exposure to STEM is linked to socio-economic level. A new 2012 report by the Girl Scout Research Institute, *Generation STEM: What Girls are Saying about Science, Technology, Engineering, and Math*, reports on findings from focus groups of 140 girls ages 8-19 in six different locations in the United States and an online survey of 852 girls ages 14-17 across the country. The sample was diverse by race/ethnicity, geography, and urbanicity.

The top findings were as follows:

- Overall, a majority of girls find STEM fields interesting.
- Girls are interested in the process of learning, asking questions, and problem solving.
- Girls interested in STEM are high achievers who have supportive adult networks and are exposed to STEM fields.

- Although interest in STEM is high, few girls consider it their number one career choice, given competing opportunities and interests. Thus, a gap exists between STEM interest and career choice.
- African American and Hispanic girls have high interest in STEM, high confidence in their abilities overall, and strong work ethic, but have fewer supports, less exposure, and lower academic achievement than Caucasian girls.
- Parental support (particularly fathers) is a key to fostering STEM interest for girls.
- Girls want to change the world, to help people.

The report concluded that girls, especially girls of color, would benefit from more exposure to what STEM can offer, more experience in STEM activities to gain confidence and to offset stereotypes, and more support/mentorship from key adults. Session attendees specifically identified the importance of having female role models of all races/ethnicities who are in the field to demonstrate the viability of career paths and counterbalance existing stereotypes. They also advocated for recognition that financial constraints alone can keep students from low-SES backgrounds from pursuing the types of STEM careers that require extensive education. This must be recognized and addressed.

Resources

- *The Double Bind: The Price of Being a Minority Woman in Science (*1976, by Shirley Mahaley Malcom, Paula Quick Hall, and Janet Welsh Brown, American Association for the Advancement of Science, Office of Opportunities in Science): http://web.mit.edu/cortiz/www/Diversity/1975-DoubleBind.pdf
- *The Double Bind: The Next Generation* (2011, by Lindsey E. Malcom and Shirley M. Malcom, Harvard Educational Review): http://www.hepg.org/her/abstract/814
- *Balancing the Scale: NSF's Career-Life Balance Initiative*: http://www.nsf.gov/career-life-balance/
- *Dual Career Academic Couples: What Universities Need to Know* (2008, Londa Schiebinger, Andrea Davies Henderson, and Shannon K. Gilmartin: http://gender.stanford.edu/sites/default/files/DualCareerFinal_0.pdf
- *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering:* http://www.nap.edu/openbook.php?record_id=11741
- 2010 Bayer Facts of Science Education XIV survey: http://www.womenscolleges.org/files/u1/BayerFactsofScienceEducation.pdf
- *Inside the Double Bind: A Synthesis of Empirical Research on Women of Color in Science, Technology, Engineering, and Mathematics* (2010, by Maria Ong, Carol Wright, Lorelle L. Espinosa, and Gary Orfield): http://www.terc.edu/work/1513.html

- *African American Women Chemists* (2011, by Jeanette Brown): http://www.oup.com/us/catalog/general/subject/HistoryOther/HistoryofScience/?view=usa&ci=9780199742882
- *Generation STEM: What Girls Are Saying About Science, Technology, Engineering, and Math* (2012, by The Girl Scout Research Institute): http://www.girlscouts.org/research/pdf/generation_stem_full_report.pdf
- *Imagine Engineering* for underrepresented girls
- *First Lego League – Robotics*, small teams of girls, with a mentoring component.

Why I Do What I Do: STEM and the Social Purpose

Discussants**:** *Judith Formalarie (Session Chair), Senior Policy Analyst, State Employment and Training Commission; Anna Kuchment, Senior Editor,* Scientific American*; Kristen Labazzo, Ph.D., Senior Scientist, Research and Development, Celgene Cellular Therapeutics; and Ann Lee-Jeffs, Product Stewardship/Sustainability Global Leader, Johnson & Johnson*

Anna Kuchment opened the session by describing the results of a survey of men and women science majors. The survey found that most became interested in science in elementary school, with high school being the second most prominent time. Boys were more likely to have been influenced in their choice of career by a parent, while girls were more likely to identify teachers as their primary influence. The factors identified by boys as leading them toward science careers included individual explorations and "tinkering," while girls identified liking to solve math problems and enjoying the outdoors.

Work today integrates multiple topics, and schools have a long way to go to catch up to this model of learning. There is a need to integrate all aspects of thinking from STEM work to marketing. There is a huge creative element in STEM, which can be quite attractive to middle and high school students if taught with enthusiasm.

Women tend to seek out a social purpose in their work, and STEM can meet that need. However, we must begin introducing children at young ages to the connection between work and purpose. If they are introduced to global challenges and the role of individuals and communities within these challenges, they will be better equipped to connect concrete knowledge and skills to solution-based activities. As an example, one panelist noted that students can be introduced to the production factors that affect the cost of goods, such as the clothing they wear. Students can also be encouraged to turn their knowledge into advocacy.

One of the challenges in connecting STEM to a social purpose is that the work often does not have immediate impact. For this reason, it becomes important to connect what have

stereotypically been viewed as individual and "lonely" jobs to the social aspects of the work. Some students will be encouraged by opportunities to link the work they may be doing to the work of others, thereby gaining a sense of the ultimate purpose. In pharmaceutical research, for example, a scientist may work for many years without having a drug that makes it onto the market. The mass public tends to lack understanding and appreciation of the incredible amount of "behind the scenes" work that lays the foundation for each advancement.

Another issue identified by session attendees is the idea that committed scientists do "only science," rather than having rich personal or extracurricular lives. One couple in attendance shared that they see their professional work as very satisfying and rewarding but that they are also contributing to the social good by raising a family. Overall, panelists and attendees argued that students and professionals, as well as their schools and employers, benefit from having rich lives outside the workplace. Extracurricular activities such as volunteering in the local community can help individuals build those "soft skills" (e.g., communication skills) that are increasingly valued in a global marketplace.

Session attendees identified several resources for connecting science to social purpose:

- The "Find a Scientist" program from Scientific American brings a scientist into classrooms (http://www.scientificamerican.com/1000scientists/find-a-scientist)
- Bring your child to work day
- Liberty Science Center (http://lsc.org/)
- Science Fairs through Scientific American and Google (http://www.scientificamerican.com/science-in-action/)
- Association for Women in Science (http://www.awis.org/)
- Healthcare Businesswomen's Association (https://www.hbanet.org/)

Johnson & Johnson has a highly successful bridge to employment program in which four high school youth are assigned to two mentors. At first, the youth tend to be timid, but, through the mentoring program, they meet with different people and learn how to communicate and present. While fewer than 30 percent of students in their schools went to college, all of the J&J program students went. This constitutes an excellent example of a broadly beneficial public-private partnership.

Recommendations

Numerous recommendations emerged from the *Sixth Annual Women in New Jersey's Science and Technology Workforce Summit*. Recommendations are grouped below according to their

audience or level of impact: industry, educational institutions, students and job seekers, and public policy.

Recommendations for Industry

Mentorship

1. Formalize mentoring in the workplace
2. Incentivize mentoring
    a. Employees who mentor others ~
        i. are investing in productivity and retention
        ii. are raising the company's profile in the community
    b. In academia, mentoring others could be part of tenure consideration
    c. In other fields, mentoring others could be part of promotion criteria
    d. Diversity in mentors
        i. By race/ethnicity
        ii. By caregiving role

Education

1. Invest in elementary, middle, and high school programming
    a. Student can be invited to "shadow" scientists
2. Invest in internships
3. Incentivize worker participation in Career Days and other school and after-school programs

Workplace Culture

1. Consider the "business case" for flexibility
    a. For women and for emerging workers, there may be considerations more powerful than salary, such as…
        i. expectations that your research will come before all else,
        ii. expectation that you will be in the lab at all hours,
        iii. publish or perish
2. Emphasize the relevance and social good of the work

Recommendations for Educational Institutions

Curriculum

1. Integrate hands-on learning opportunities
    a. E.g., not just explaining what the slope of a line is, creating it
2. Reconsider marketing
    a. The term STEM may be off-putting to students *and* parents
3. Consider girls-only sections
    a. Research tends to support the advantage of single-gender education, particularly in gender-segregated fields
4. Support innovative teaching practices
    a. E.g., "tinkering" stations
5. Develop or adopt hands-on textbooks and other materials
    a. More than memorization
6. Adopt integrative curricula
    a. Teaching across the curriculum

Teacher Education

1. Invest in core training for educators
    a. Multi-disciplinary
        i. avoid the traditional math/reading/science silos
    b. Ongoing
        i. foster collaboration between faculty teachers, mentor teachers, and teachers from different departments
        ii. include classroom observations and formal and informal meetings
2. Adopt team teaching approaches
    a. Multi-disciplinary
    b. Students can strengthen "core" skills (NCLB) *and* learn science
3. Emphasize the importance of the invitation for girls
    a. Formal or informal
    b. Girls overestimate the math skills they need to be successful in engineering

Mentorship

1. Formalize systems of teacher mentorship
2. Support and reward teachers who mentor other teachers or students

3. Adopt peer mentoring programs (e.g., older students to younger students)

Community-Based and Afterschool Programs

1. Organize and support public-private partnerships (shared recommendation with Industry and Public Policy)
    a. Examples:
        i. Project Lead the Way
        ii. Children Designing and Engineering (K-5)
        iii. Future Engineers of Trenton (middle school)
2. Develop math/science programs for parents
    a. Anxiety about math/science can be passed on to their children

The Pipeline

1. Invest in career counseling
    a. Counselor/guides who understand the multiple pathways that can be taken to rewarding, well-paying work
        i. "not everyone has to go to college"
2. Expand use of prior learning assessments
    a. Credit for past experience and education
    b. Emphasize stackable credentials

Alumnae

1. Use your alumnae to…
    a. Be a role model of success in the field
    b. Mentor students considering going into their field
    c. Offer shadow days/ or internships to students interested in exploring the field
    d. Advocate for policies that support and promote women in STEM throughout the institution
    e. Give feedback particularly on their own experience at that institution and how it could be improved

The Social Purpose

1. Link STEM education to a social purpose, to social goods

    a. Youth in general are attracted to work that is visibly linked to meaning and positive change
2. Link STEM careers to sustainable, well-paying work
    a. Girls are contextual thinkers
        i. They must see that STEM careers will allow them to make good money *and* lead satisfying lives
3. Counteract stereotype of lone worker in a lab
    a. Not just a problem with connecting to social good but connecting to people more generally!

Recommendations for Students and Job Seekers

For Transitioning Workers

1. Use courses to layer on top of experience and credentials
2. Market experience to non-profits and early stage start-ups
3. Get toe in door (might require career flexibility)
4. Use talent networks (Jobs4Jersey)
5. Use Massive Open Online Courses (MOOC), which are free
6. Actively make connections across the industry
    a. Keep track of where opportunities are
    b. May end up creating your own job
7. Consider offering advice and insight pro-bono
    a. To gain visibility and connect with early-stage businesses

For Scientists/Citizens

1. Get involved with Career and Technical Education advisory panels and committees
2. Participate in town hall meetings
    a. Interact with those they are helping

For Entrepreneurs
"Whether selling a new idea or promoting ourselves, we are all entrepreneurs."

1. Focus on branding and perception
    a. Remember that investors are "investing in the person, not the idea"
2. Develop your own public speaking skills or hire an excellent public speaker
3. Acquire knowledge of finance and cash flow

4. Acquire knowledge of people management
5. Be flexible
6. Be able to implement
7. Get on a business advisory board
    a. Networking
    b. Expanding funding
8. Focus hiring on offsetting weak areas
9. Network
    a. Tell people what you want and ask for help
10. Find out what people need, connect them with other people or help them yourself

Recommendations for Public Policy

1. Invest in "play" spaces for dislocated workers and young people
    a. For example, Maker or Hacker spaces at Rutgers provide opportunities to learn or master skills, demonstrate proficiency, build "portfolios" of work
2. Expand financial support for education
    a. Particularly in low-income communities
3. Expand the use of apprenticeships and internships
4. Support NJ Life Sciences Talent Network
    a. capital,
    b. facilities & equipment, and
    c. talent

The New Jersey Council on Gender Parity in Labor and Education is sharing the recommendations made in these sessions with its members, with the New Jersey State Legislature, and with appropriate State Agencies.

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