

MEMO

**to the EDUCATE to INNOVATE CAMPAIGN
from "the JULY 19" COLLABORATION"**

and

REPORT

on "the JULY 19" COLLABORATION" Meeting

August, 2010

FOREWORD

On November 23, 2009 President Obama launched “Educate to Innovate”, a nationwide effort to help reach the administration’s goal of moving American students from the middle to the top of the pack in science and math achievement over the next decade by improving the participation and performance of America’s students in science, technology, engineering, and mathematics (STEM) fields. This campaign has included the efforts not only of the Federal Government but also those of leading companies, foundations, non-profits, and science and engineering societies, focused on helping young people across America excel in science and math. The administration’s “Educate to Innovate” campaign names three priorities:

- Increase STEM literacy so that all students can learn deeply and think critically in science, math, engineering, and technology;
- Move American students from the middle of the global pack to top in the next decade; and
- Expand STEM education and career opportunities for underrepresented groups, including women and girls.

As the co-chairs of the National Coalition for Women and Girls in Education (NCWGE), we are very concerned with the administration’s action in support of the third priority. NCWGE is a nonprofit coalition of over 40 groups formed in 1975 to educate the public about issues concerning equal rights for women and girls in education, to monitor the enforcement and administration of current legislation related to equal rights for women and girls in education, to perform and publish research and analysis of issues concerning equal rights for women and girls in education, and to take the steps necessary and proper to accomplish these purposes.

The July 19, 2010 Girls in STEM Collaboration convened practitioners and policy makers and gathered grassroots feedback. This was part of a significant effort to provide the administration with recommendations for its Educate to Innovate Campaign. The recommendations – contained in this report – are fully supported by NCWGE and represent the collective knowledge of the many leaders in both STEM program implementation and public policy development. They speak volumes to the impact that administration-supported policies and funding priorities can have. The recommendations include specialized teacher professional development, targeted public media campaigns, and incentives to encourage public/private collaboration. However, none of these strategies will have the impact we are seeking if they are relegated to the background of a broader agenda. We often see the phrase “serving all students, including underrepresented groups and women and girls” in many education program announcements and funding applications. Just as the voices heard in this report have said – this is an issue that must be addressed head on with strategies targeted to meet the needs of women and girls.

The original press release from the White House announcing the Educate to Innovate campaign says: “As part of the campaign, this Administration hopes to do a series of events, announcements and other activities that build upon the President’s ‘call to action’ and address the key components of national priority.” We challenge the administration to build on the grassroots effort started by the Girls in STEM Collaboration; to conduct events, make announcements and create a groundswell explicitly focused on increasing the participation of women and girls in STEM education and careers. Through the convening and this report, we have responded to the “call to action.” We look forward to a dialogue where the recommendations in this report, and future opportunities for feedback, trigger additional public policies and funding

priorities that expand STEM education and career opportunities for women and girls. If you have any questions, please feel free to contact Lisa Maatz at 202-785-7720 or Fatima Goss Graves at 202-588-5180.

Sincerely,

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MEMO to the EDUCATE to INNOVATE CAMPAIGN

From "the JULY 19" COLLABORATION"

August, 2010

The Educate to Innovate Campaign launched by President Obama in 2009 has three goals: increase science, technology, engineering, and mathematics (STEM) literacy, move American students from the middle of the pack to top, and expand STEM education and career opportunities for underrepresented groups, including women and girls.

The community of research and practice on women and girls in science and engineering recommend a priority on several key strategies for achieving all three goals, based on the wisdom of their experience and informed by evidence of effectiveness and research on root causes behind the gaps. Rather than respond with many minds and many voices, we convened a meeting to collaborate on a single response. More detail on the process and participation is available in a report (same title as above).

To achieve the outcomes of greater literacy in science and engineering, better academic performance by America's students, and better diversity in a science and engineering workforce that recruits the talents of all students, **WE**

RECOMMEND that the following **educational strategies** be given top priority for focus and/or investment:

1. **Help teachers change their interactions with students to engage and motivate all students**, by learning and acting to dispel stereotypes, build self-efficacy and confidence in students, change the classroom climate for underrepresented students, and change the mindset of everyone that these talents can be learned by many, not few. Research on bias and discrimination, the effects of stereotypes on test scores, the relationship between attitudes and interest in science and engineering – should be incorporated in pre-service and in-service professional development of teachers. Sensitivity and skills related to multi-cultural and gender dynamics should be incorporated in professional standards.
2. **Support programs that expose students to diverse role models and mentors** who are happily in the science and engineering workforce. Students are inspired and informed through contact with working scientists and engineers, especially those who look like them. Having speakers visit students and students visit work sites is effective in building career awareness and aspirations toward solving real problems in the world. Mentoring relationships can compensate for lack of knowledge about career options, how to prepare, and what professional life really means, as well as convey the passion of working professionals. This exposure has been shown to change the image of science and engineering, and the image of scientists and engineers.
3. **Emphasize the awareness and adoption of new ways of teaching STEM that have proven to engage and recruit more students**. Both in school and out-of-school settings, evidence shows that hands-on, inquiry-based learning is more fun and productive for discovering the scientific method and grasping basic principles and facts. Learning cooperatively in teams, solving problems that are relevant to students, treating study like a research project – all are possible in both settings. Technology can be integrated with school learning as it is in real life. Most adults in our society did not experience science and math classes this way.

These principles and methods should be incorporated in pre-service and in-service professional development of teachers.

4. **Increase the number of TV programs that spark interest in STEM subjects** and that counter stereotypes about who does science, how much fun it is, and careers. Increase the number of shows that consciously employ features and styles that appeal to girls based on research, and messaging found to be most effective to encourage career interest. Well-designed TV programs provide substantive content, tied to state educational standards, and can be used in-school and out-of-school. Many can serve as the launching pad for student teams and clubs to explore certain topics. They demonstrate new ways of learning science and engineering to everyone, crossing generations. They demonstrate team work, diversity in action, solving fun and interesting problems. Many come with guides for parents, teachers, and after-school leaders. This is a national curriculum potentially reaching millions of students, parents, leaders, and teachers, grounded in a familiar and fun visual medium accessible to everyone at any time.
5. **Cultivate and support collaboration among groups, companies, and leaders** working to increase and diversify the science and engineering workforce. We need to leverage small, scattered, high-quality efforts. Many are artificially siloed into subcultures such as formal versus informal education, technical training for non-traditional careers versus academic tracks, museum programs, teacher education, and career counseling. We need to facilitate public and private teaming on implementation of our best strategies.

Over 30 strategies supported by research were considered. All of them are important and effective. The group was asked to choose five as top priorities in their view, at this time.

There are examples of proven programs behind every recommendation. Experts, organizations, and industry sponsors are available to help interpret the array of resources associated with each. They are willing to help locate projects and people familiar with these strategies.

IN ADDITION, we endorse the following **government actions**:

1. **Improve the definition and perception of the problem:** Is STEM literacy deficient? Are American students not competitive? Is diversity of the science and engineering workforce an issue? Is there really a shortage of scientists and engineers that affects America's competitiveness? Make it clear, with facts. The public is not hearing enough and not convinced of the need to act. In particular, we must encourage awareness and investment in the problem of STEM education and diversity. The recent oil spill, like Sputnik, can be a wake-up call.
2. **Continue to incentivize public/private partnerships and collaborations.** Funding channels can require teaming and reward teaming, as did, for example, Department of Education's Race to the Top and I3 competitions. Many National Science Foundation programs generate new partnerships through incentives. We need a convener to bring corporations and education entities together. There is no process for connecting corporate funders with good programs. Some foundation grant giving is not effective because of a lack of understanding about what projects really need, as opposed to what funding is offered, for example, one-year grants.

3. **Reinvigorate attention to accountability for conscious and effective recruitment of underrepresented students to science and engineering education** (and to the workforce). We need a coordinated accountability system for equity at a national level. The Perkins Act (career and technical education) currently requires reporting on the participation of girls and minorities in non-traditional fields at the secondary and post-secondary levels, by state. Federal agencies that fund science and engineering are starting to conduct compliance reviews under Title IX, to monitor efforts to increase the participation and advancement of women in science and engineering. More awareness, oversight, and technical assistance is needed to help educational institutions correct for historical bias and exclusion. Historically, legislation and enforcement have made a difference.

4. **Incorporate the issues of societal impacts, ethics, and equity into the standards and curriculum for science and engineering education.** These non-scientific aspects are relevant to the conduct and success of scientific research and technology. In fact, they can interfere with public understanding and acceptance. Science cannot continue as an elite domain separate from society's reception and response. There are many examples of research and design that went wrong due to unconscious bias, narrow perspectives, and hidden value assumptions. Our children first experience a sense of identification and participation with the scientific enterprise – or not -- in the classroom. Equity and ethics are not something we “tag onto” “purely scientific” content. Social dynamics of privilege and exclusion, and bias, must be acknowledged and countered if we are going to recruit a workforce from the whole population.

RESPECTFULLY.

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About 350 individuals in the community helped prioritize the recommendations via an open invitation that reached over 8000 people. A longer report of the meeting is available at: <http://www.ncwge.org> and <http://stemcollaboration.org> .

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REPORT

on “the JULY 19th COLLABORATION” Meeting

August, 2010

A Collaboration met to develop recommendations to the EDUCATE TO INNOVATE CAMPAIGN in order to increase the participation and performance of America’s students in science, technology, engineering, and mathematics (STEM), drawing on research and practice that supports girls’ full engagement and advancement in STEM education.

Why	<p>Federal education policy makers need to identify the most effective means to quickly build a strong and diverse STEM workforce. Many communities and individuals serve women and girls in STEM education and have the wisdom of research and practice at hand. The community wanted to tap that expertise and experience to summarize and prioritize the most important strategies that makes sense at this time.</p> <p>The methods chosen exploit the power of collaboration to achieve results, asking individuals and individual organizations to put national needs above those of their own constituencies. We anticipated the community’s interest in providing feedback to the Campaign, and the need to attempt a coordinated response.</p>
How	<p>Three leaders of non-profit education organizations initiated a meeting in Washington, D.C. on July 19, 2010.</p> <p>With a short time frame from conception to execution (about one month), we sought the most expedient method for community input:</p> <ol style="list-style-type: none">1. Pre-meeting electronic brainstorming by representatives of national organizations that are familiar with research and practices related to girls and STEM (K-12) as a significant component of their activities.2. Pre-meeting electronic brainstorming by the wider community of practice, as input to the meeting of representatives.3. An in-person meeting to discuss and prioritize recommendations.4. A short list of recommendations to the Educate to Innovate Campaign, with a report back to participants in the process.
Goal	<p>The goal was to leverage the best information possible, based on sound research and effective practices, to identify the top priorities to address the problem area of girls and women in STEM education. The recommendations are based on the opinions of organizations closest to the issue, with input from the wider community of practice.</p>
Report	<p>The details of both electronic brainstorming and the in-person meeting will be shared with everyone involved.</p> <p>The resulting recommendations to the Educate to Innovate Campaign will be transmitted by the National Coalition for Women and Girls in Education (NCWGE), STEM Taskforce.</p>

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Constraints

- We wanted as much participation from the community as possible within one month.
- There were no resources or special funding allocated for this project.

EDUCATE TO INNOVATE BACKGROUND

From <http://www.whitehouse.gov/issues/education/educate-innovate> :

“President Obama has launched an ‘Educate to Innovate’ campaign to improve the participation and performance of America’s students in science, technology, engineering, and mathematics (STEM). This campaign will include efforts not only from the Federal Government but also from leading companies, foundations, non-profits, and science and engineering societies to work with young people across America to excel in science and math.

As part of the campaign, this Administration hopes to do a series of events, announcements and other activities that build upon the President’s “call to action” and address the key components of national priority.

Why This is Important

We have many great schools, excellent teachers, and successful students in America. But there are also troubling signs that, overall, our students should be doing better in math and science.

- In the [2006 Programme for International Student Assessment \(PISA\) comparison](#), American students ranked 21st out of 30 in science literacy among students from developed countries, and 25th out of 30 in math literacy.
- On the [2009 National Assessment of Educational Progress \(NAEP\) math tests](#), 4th graders showed no signs of progress for the first time in many years, and 8th graders tallied only modest evidence of progress. We are not advancing as we must.

What We Must Do

Through ‘Educate to Innovate’ and other efforts, we must:

- Increase STEM literacy so that all students can learn deeply and think critically in science, math, engineering, and technology.
- Move American students from the middle of the pack to top in the next decade.
- ***Expand STEM education and career opportunities for underrepresented groups, including women and girls.***

The First Steps

America is already stepping forward to meet these challenges. As part of the “Educate to Innovate” effort, five major public-private partnerships are harnessing the power of media, interactive games, hands-on learning, and community volunteers to reach millions of students over the next four years, inspiring them to be the next generation of inventors and innovators.

- [Time-Warner Cable](#), [Discovery Communications](#), [Sesame Street](#), and other partners will get the message to kids and students about the wonder of invention and discovery.
- [National Lab Day](#) will help build communities of support around teachers across the country, culminating in a day of civic participation.
- [National STEM design competitions](#) will develop game options to engage kids in scientific inquiry and challenging designs.
- Five leading business and thought leaders (Sally Ride, Craig Barrett, Ursula Burns, Glen Britt, and Antonio Perez) will head an effort to increase private and
- philanthropic involvement in support of STEM teaching and learning.”

RECOMMENDATIONS TO THE EDUCATE TO INNOVATE CAMPAIGN

The recommendations are transmitted in a document called “Memo to the Educate to Innovate Campaign from the July 19th Collaboration.”

STEM
Teachers, New
Methods

1. **Help teachers change their interactions with students to engage and motivate all students**, by learning and acting to dispel stereotypes, build self-efficacy and confidence in students, change the classroom climate for underrepresented students, and change the mindset of everyone that these talents can be learned by many, not few. Research on bias and discrimination, the effects of stereotypes on test scores, the relationship between attitudes and interest in STEM – should be incorporated in pre-service and in-service professional development of teachers. Sensitivity and skills related to multi-cultural and gender dynamics should be incorporated in professional standards.

Role Models
and Mentors

2. **Support programs that expose students to diverse role models and mentors** who are happily in the STEM workforce. Students are inspired and informed through contact with working scientists and engineers, especially those who look like them. Having speakers visit students and students visit work sites is effective in building career awareness and aspirations toward solving real problems in the world. Mentoring relationships can compensate for lack of knowledge about career options, how to prepare, and what professional life really means, as well as convey the passion of working professionals. This exposure has been shown to change the image of science and engineering, and the image of scientists and engineers.

STEM
Teachers,
Gender &
Multi-cultural
Dynamics

3. **Emphasize the awareness and adoption of new ways of teaching STEM that have proven to engage and recruit more students**. Both in school and out-of-school settings, evidence shows that hands-on, inquiry-based learning is more fun and productive for discovering the scientific method and grasping basic principles and facts. Learning cooperatively in teams, solving problems that are relevant to students, treating study like a research project – all are possible in both settings. Technology can be integrated with school learning as it is in real life. Most adults in our society did not experience science and math classes this way. These principles and methods should be incorporated in pre-service and in-service professional development of teachers.

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| TV Programs | 4. Increase the number of TV programs that spark interest in STEM subjects and that counter stereotypes about who does science, how much fun it is, and careers. Increase the number that consciously employ features and styles that appeal to girls based on research, and messaging found to be most effective to encourage career interest. Well-designed TV programs provide substantive content, tied to state educational standards, and can be used in-school and out-of-school. Many can serve as the launching pad for student teams and clubs to explore certain topics. They demonstrate new ways of learning STEM to everyone, crossing generations. They demonstrate teamwork, diversity in action, solving fun and interesting problems. Many come with guides for parents, teachers, and after-school leaders. This is a national curriculum potentially reaching millions of students, parents, leaders, and teachers, grounded in a familiar and fun visual medium accessible to everyone at any time. |
| Collaboration, Public/ Private Partnership | 5. Cultivate and support collaboration among groups, companies, and leaders working to increase and diversify the STEM workforce. We need to leverage small, scattered, high-quality efforts. Many are artificially siloed into subcultures such as formal versus informal education, technical training for non-traditional careers versus STEM education tracks, museum programs, teacher education, and career counseling. We need to facilitate public and private teaming. |

NOTES ON THE TOP CONSIDERED STRATEGIES

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| Presenters on TOP TEN Strategies Considered at the Meeting | <p>Participants were asked to provide more detail on each of the Top Ten proposed recommended strategies:</p> <ol style="list-style-type: none"> 1. Training for STEM Teachers in Instructional Strategies, <i>Mimi Lufkin</i> 2. Showcase Role Models and Mentors, <i>Linda Kekelis</i> 3. Training for STEM Teachers in Interaction Strategies, <i>Catherine Hill</i> 4. Support TV Programs/Media, <i>Tricia Berry</i> 5. Cultivate Collaboration and Leverage Ongoing Work, <i>Kate Pickle</i> 6. Training for School Counselors, <i>Jessica Bullock</i> 7. Educate Parents, <i>Claudia Morrell</i> 8. Support a National Clearinghouse, <i>Ruta Sevo</i> 9. Provide Customized Programs for Underrepresented Groups, <i>Laura Huerta</i> 10. Training for Informal Programs in Interactive Educational Strategies, <i>Stephanie Lemnios</i> |
| STEM Teachers, New Methods | <p>Many teachers don't know that the low participation of girls is a problem in career technical education. How do we get them interested? The training experience has to create a sense of need. There are two measures required under the Perkins Act that show the numbers of students (disaggregated by gender, race/ethnicity and special population status) in each state participating in technical training for nontraditional careers (e.g. STEM). When analyzed closely for girls and other underrepresented groups participation in STEM related programs of study these numbers are dismal, often less than 10%, indicating a significant need for more efforts to be made to balance the scale.</p> <p>There is no single toolkit, but effective teacher training has been piloted. NAPE has experience working with ten states on this.</p> |

This is a critical strategy because the influence of the teacher is powerful. The classroom is a captive audience. It reaches nearly all children. We can change their first experience of science, math, and technology to be more positive.

“You would not teach football by lecturing about it for 20 years.”

“It is very difficult to teach inquiry if you have never experienced it.”

Role Models and Mentors

Role models are effective in making a difference in children’s perceptions of careers. For a student, they can turn a hobby interest into a career interest. Role models and mentors can be “near-peers” – slightly older students. Training is important to achieve the positive results found in research.

STEM Teachers, Gender & multi-cultural Dynamics

AAUW recently published *Why So Few?* as a summary of research on psychological and societal dynamics that discourage girls and under-represented minorities from pursuing STEM fields. For example, the effect of negative stereotypes can be seen and measured in test scores. Teachers can learn about these effects and adopt specific behaviors to counteract them.

Another example is whether teachers (and others) hold a “fixed” mindset or a “growth” mindset – whether they believe our skills are innately determined or whether we believe math and other skills can be learned. Researchers find a measurable difference in performance of students based on these attitudes.

We know that girls tend to have higher standards for themselves when they assess their own abilities to do math and science. This can be addressed and changed.

Basically, many people and many teachers are not aware of these dynamics. Knowing them, and interacting with students differently, can make a difference in recruiting more students to STEM.

TV Programs

One of the most important contributions of TV shows is that they show role models that challenge our stereotypes. They can embed messaging about careers, for example, drawing on the National Academy of Engineering research on effective messages. They reach all of the public, not just educators.

There are excellent examples: the Engineer Your Life videos, the Association for Engineering Education Grand Challenges video, Texas Instruments’ “Thank an Engineer.” Among PBS programs, Design Squad, Cyberchase, Dragonfly TV, Zoom, and SciGirls aimed at children, plus the science series, NOVA and others aimed at everyone. There are educational videos on YouTube and Hulu that have been vetted and are tied to state standards for learning.

Collaboration

There are many examples of collaboration between educational entities and community-based organizations that show a greater impact as a result of the collaboration. They are also more sustainable than independent projects.

One example is the Girl Scouts providing a program that draws on professional role models provided by the Society of Women Engineers, and uses TV programs (Design Squad, Fetch) as their core material for activities.

Some collaborations bridge community programs and schools by bringing programs into school settings and after school programs. Motorola, for example, requires that its Innovation Generation Grantees cross this bridge and work together.

Career Advice from Counselors	<p>Collaborations are a means of tying together the levels of the pyramid – from education to workforce. The agenda of workforce development gets embedded in community programs reaching younger children and their parents.</p> <p>We need more materials for counselors on STEM careers that feature the workforce needs and feature the accomplishments of each type of career. We should emphasize the pathways to high-paying high-tech jobs. They are important regardless of gender.</p>
	<p>For example, Oklahoma has a Department of Career Education. There are 37 programs in high schools. Students can spend ½ days in pre-engineering academies. Regular counselors are overwhelmed. An additional career advisor is at each school very day during the week. The program is unique to Oklahoma.</p>
Parents	<p>Students don't know what scientists and engineers do. Bringing in role models and mentors works. The Oklahoma programs have a "great conversion rate" among student to become interested in STEM.</p> <p>There is more than 40 years of research on what influences a student's career interest. The number one factor is parents. Mothers are most influential regarding their daughter's career choices. Family cultures have preferences for certain careers and biases. Parents are the first and most important advocates for their children. Many female engineers cite the influence of their father's in choosing their field. It is difficult for children to challenge a dominant culture that, for example, discourages girls from becoming engineers or mathematicians. Programs have found that changing the parents' views toward STEM careers is a good way to nurture the interest of children and recruit them to careers that may be "nontraditional" in their families or in society.</p>
National Clearinghouse	<p>There are many small and high-quality examples of efforts to collect information about national programs and resources. Almost all have not sustained funding beyond 3-5 years. Because the current funding structures from NSF do not provide long-term operational support, the scope is usually narrow and short-term.</p> <p>Two national reports in 2000 and 2006 have recommended a national coordinating and clearinghouse entity.</p> <p>We would leverage small and scattered investments better with a larger, longer effort with a broad scope. We would reduce duplication, frustration, and gain more momentum with this resource.</p> <p>One of the difficulties in gaining funding is that the function is not showy. It is infrastructure.</p>
Customized Content for Specific Groups	<p>Different underrepresented groups face different barriers to learning and stereotypes. Ideally, the content of science and math classes could reference experiences that are meaningful and relevant to subgroups such as inner city African American boys. Many youth development initiatives are finding that customization is key to effectiveness, for example, the Community & Urban Science Enrichment (CAUSE) program in Camden, NJ, with its "whole child" approach. Also, Youth Alive! a program dedicated to preventing youth violence and generating youth leadership in California communities experiencing high rates of violence.</p>
Out-of-School, Gender & multi-Cultural Dynamics	<p>Many leaders of youth programs (after school, summer camp, clubs, one-day events, museum education) are new to the topic of gender dynamics in learning settings, and their affect on engagement and interest in STEM. More than ever, the out-of-school setting is important for science learning. Providing training and guidance on the psychological dynamics that are different between girls and boys, and minority and majority students – stereotype threat, self-efficacy, a mindset about whether everyone</p>

can learn or whether you must be born with extreme talent to do science – these can change one of the biggest barriers to student interest at early ages.

ADDITIONAL DISCUSSION POINTS

Corporate Investment, Motivation	Corporations are investing in STEM education because of an interest in having a pool of skilled workers. They are investing in education as a long-term means to that end. They already see the connection between investing in informal education and getting a larger pool of graduates eventually. We know that 80% of a child’s time is out-of-school. We see that the participation of children in out-of-school programs changes their attitudes about careers. They gain a sense of identity with the STEM professional community. This has been measured.
Role for Public/ Private Partnership	<p>We need events that build awareness, to get the message out about the issue. Bring attention to the need for action and partnerships. “You get what you celebrate.”</p> <p>There is a need for more information about what it takes build successful partnerships. There are reports of successful partnerships as a result of incentives in Race to the Top, but we don’t know much about them. We need to be able to point to specific things that should be done – lessons learned. We need to draw attention to the successes.</p>
Incentives to Act	<p>The Race to the Top application had a priority on increasing the participation of women and underrepresented groups. How many states actually addressed that priority, and what did they suggest as action plans? Did that play a big role in who won the funding?</p> <p>One state got a low score and very bad press for not addressing recruitment of girls and women. It is all available online.</p> <p>Race to the Top also was impactful with state agencies in validating partnerships between formal and informal education. There was a ripple effect. People wanted to be “on the application” and become part of a holistic system. It had this effect even if there were not going to get funding directly from it.</p>
Need for National Coordination	<p>We need for more systematic support for current efforts. We have identified “semi-magic-bullets” to solve the problem. None are coordinated at a policy level.</p> <p>Corporations need to know more about what strategies are good investments, and how to find partners.</p>
Measuring ROI; Linkage to Workforce	<p>The return on investment (ROI) on each strategy can be estimated. The Library of Congress Congressional Research Service can be asked to describe potential impacts. This is often part of developing new legislation. However, some things cannot be easily measured, for example, the effect of changing the climate in classrooms.</p> <p>If the ultimate goal is workforce participation, we need to link educational outcomes to workforce. We don’t do that very well in any case. It takes longitudinal studies. We are interested in the whole “pyramid” with education at the bottom and workforce at the top. Engaging student interest is not the end goal.</p> <p>We should not over-think the process. Resources are missing at the bottom of the pyramid. We should continue to create resources at every level.</p>

Why Gaps in STEM but not Law & Medicine?	<p>Title IX opened education in medicine, law and other professional fields. Prior to Title IX there were quotas for women in medical school. Medical schools admit students as a class and a cohort, whereas recruitment to science and engineering fields occurs at a department level. There is less coordination and conscious effort to diversify.</p> <p>The image of science and engineering is a documented barrier to attracting students. Female students especially want to be in helping fields, thus the attraction to medicine.</p>
Gap between Law and Action; Accountability	<p>There are gaps between policy and action. The Perkins Act and Title IX say “you have to do this.” We need to provide help to fill this “sandwich.” Educational entities need technical assistance on what to do differently, especially proven approaches.</p> <p>In Wisconsin, civil rights and education intersect in the career and technical education office. Equity is not a policy in education, but in career and technical education – workforce development. There used to be gender equity and Title IX coordinators.</p> <p>We have to be careful about government mandates without adequate resources, for example, compliance requirements we cannot afford.</p>
Perception of the Talent Problem: Is There a Shortage?	<p>An education in science and engineering is good for a lot of things. People studied English as a “good degree” for general purposes. A law degree is the same way. There is a perception that science and engineering training are must be specialized and focused. The oil spill in the Gulf shows the range of skills we need to solve urgent problems.</p> <p>The military is finding only a small percentage of youth are eligible to serve for various reasons, including basic skills. Yet there are 99,000 jobs in laboratories. There are 200,000 people with STEM degrees in the military.</p>

ADDITIONAL RECOMMENDATIONS FOR GOVERNMENT ACTION

Based on the discussion, the July 19th Collaboration endorses the following policy goals.

Is There a Problem?	<p>5. Improve the definition and perception of the problem: Is STEM literacy deficient? Are American students not competitive? Is diversity of the STEM workforce an issue? Is there really a shortage of scientists and engineers that affects America’s competitiveness? Make it clear, with facts. The public is not hearing enough and not convinced of the need to act. In particular, we must encourage awareness and investment in the problem of STEM education and diversity. The recent oil spill, like Sputnik, can be a wake-up call.</p>
Public/ Private Collaborations	<p>6. Continue to incentivize public/private partnerships and collaborations. Funding channels can require teaming and reward teaming, as did, for example, Department of Education’s Race to the Top and I3 competitions. Many NSF programs generate new partnerships through incentives. We need a convener to bring corporations and education entities together. There is no process for connecting corporate funders with good programs. Some foundation grant giving is not effective because of a lack of understanding about what projects really need, as opposed to what funding is offered, for example, one-year grants.</p>

- Accountability
7. **Reinvigorate attention to accountability for conscious and effective recruitment of underrepresented students to STEM education** (and to the STEM workforce). We need a coordinated accountability system for equity at a national level. The Perkins Act (career and technical education) currently requires reporting on the participation of girls and minorities in non-traditional fields at the secondary and post-secondary levels, by state. Federal agencies that fund science and engineering are starting to conduct compliance reviews under Title IX, to monitor efforts to increase the participation and advancement of women in science and engineering. More awareness, oversight, and technical assistance is needed to help educational institutions correct for historical bias and exclusion. Historically, legislation and enforcement have made a difference.
- Equity, Ethics, and Societal Impacts Are Part of Science
8. **Incorporate the issues of societal impacts, ethics, and equity into the standards and curriculum for STEM education.** These non-scientific aspects are relevant to the conduct and success of scientific research and technology. In fact, they can interfere with public understanding and acceptance. Science cannot continue as an elite domain separate from society’s reception and response. There are many examples of research and design that went wrong due to unconscious bias, narrow perspectives, and hidden value assumptions. Our children first experience a sense of identification and participation with the scientific enterprise – or not -- in the classroom. Equity and ethics are not something we “tag onto” “purely scientific” content. Social dynamics of privilege and exclusion, and bias, must be acknowledged and countered if we are going to recruit a workforce from the whole population.

NOTES ON FURTHER ACTIONS FOR THE COLLABORATION

The community clearly thinks that there are many strategies that are important, not just those that made the short list.

These “July 19th” recommendations should inform legislation. The American Educational Research Association (AERA) has posted a call for topics to be the subject of research briefs to inform policymakers. STEM is a priority area now.

The reauthorization of the Perkins Act is another opportunity to strengthen accountability, measures, and technical assistance.

The UN Commission on the Status of Women has a meeting in March. We need a campaign to understand what is at stake and the value of doing this. How do we bring the international/global and domestic pieces together? It may be worthwhile to have a follow-up meeting on international connections. Many people in the international arena got their educations in the U.S. They understand how we can collaborate, especially on resources, programs, and experts.

There is a need for more ways to get the message out about the talent crisis. We can use technology to continue this conversation.

We need to showcase successful public/private partnerships working on STEM education and diversity/equity. Lessons learned, examples, guidance on success factors.

PROCESS BEHIND THE MEETING

In-Person Meeting in Washington, DC

Up to 20 representatives of national organizations that are familiar with research and practices related to girls and STEM (K-12) as a significant component of their activities were invited to attend the small meeting. They represent well-known, long-term stakeholders with significant experience.

Many of the invitees are associated with a standing organization, the National Coalition for Women and Girls in Education (NCWGE) STEM Taskforce. The STEM Taskforce will take on the task of communicating with the Educate to Innovate Campaign, publicize the report of this meeting, and follow up. Some organizations invited to the meeting are not currently members of the NCWGE STEM Taskforce.

In addition, people specializing in STEM education and gender diversity in the Federal government were invited to attend the meeting to listen.

At the in-person meeting in Washington, participants were to elaborate, discuss, refine, and rank suggestions to be included in the final list.

Pre-Meeting Inputs: Electronic Brainstorming

In order to accelerate our group's ability to discuss and arrive at recommendations from a fairly complex and large amount of information, we employed a pre-meeting, electronic brainstorm process based on the Delphi method.

Invitees to the meeting were asked to rank, anonymously, the importance of various types of strategies, programs or agendas that have been proven to be effective and should be recommended for investment.

There were two rounds of brainstorming in this fashion, each allowing for a week for response. The second round showed every candidate strategy along with preliminary rankings by those participating in the first round, and rankings by the "open" brainstorm as well.

Out of these two rounds of feedback, we had a ranked list of ideas/strategies that comprised the agenda for the in-person meeting. We had preliminary opinions, noted anonymously, to narrow the number of strategies to discuss in person and to consider for recommendation.

Source of Target Strategies

Straw recommendations or "strategies" were taken from a document produced by the National Alliance for Partnerships in Equity. See *Nontraditional Career Preparations: Root Causes and Strategies*, found at <http://02b47b1.netsolhost.com/foundation/page.php?55>

The report is organized by areas of influence, such as Education, Career Information, Family, Internal/Individual, Societal Issues. Under each area, Root Causes are identified, and a Theory about the Root Cause. Then Strategies addressing the Root Causes are given. Evidence for each Theory is discussed in Part II of the report, as well as Effective Practices and Resources.

Many of the strategies have been implemented by specific programs, some named in the report and others described in other resources. Many national policy reports on STEM education and the problem of how to increase the participation of women, minorities, and persons with disabilities have made recommendations along the same lines.

Community Inputs

In order to hear the opinions of those in the wider community, we conducted a second, parallel, electronic brainstorm process. The same list of strategies was presented in a separate URL.

An invitation to participate was issued via email lists for various communities known to be important stakeholders. The lists reached over 8000 people, through:

- NAPE, MDWIT, NSF Gender in Science and Engineering grantees, Women in Engineering Proactive Network (WEPAN), Girl Scout Councils, State Departments of Education, AAUW, Facebook, NGCP Champion Board, Collaborative leadership teams, and programs, and National Coalition for Women and Girls in Education (NCWGE).

Individuals were asked to register, although their opinions and voting were kept anonymous.

Two rounds of feedback were prepared. The first collected priorities, including “Top Five” votes. The second presented the full list with the strategies listed in priority order, based on the first round feedback. In the second round, respondents were asked to pick “Top Five” again, in order to refine the ranking.

The community input from this brainstorming was provided to the participants in the meeting separate from their own brainstorm, as a way of seeing what the wider community thought about the same list of strategies.

Electronic community brainstorming constitutes a “crowd-sourced” focus group. People within the wider network are given the opportunity to “weigh in” with their opinions. It was an economical way to vet a list of ideas given our resources and timeframe.

Meeting Agenda

Welcome and Introductions
Project Overview and Purpose of Meeting
Survey Results Presentation and Discussion
“Top 10” Presentations and Discussion
Listening Panel Questions and Comments
Final Ranking Activity and Discussion
Report Structure, Next Steps, Planned Follow-up

MEETING PARTICIPANTS

Conveners & Discussants Karen Peterson, PI, National Girls Collaborative Project and CEO, EdLab Group (kpeterson@edlabgroup.org; www.edlabgroup.org)

Mimi Lufkin, CEO, National Alliance for Partnerships in Equity (mimilufkin@napequity.org; <http://stemequitypipeline.org/>)

Claudia Morrell, CEO, Multinational Development of Women in Technology (cmorrell@mdwit.org; www.midwit.org)

Writer: Ruta Sevo, Momox (ruta@momox.org; <http://momox.org>)

- Discussants
- Catherine Ashcraft, National Center for Women in Information Technology (catherine.ashcraft@colorado.edu)
- Lauren Baker, Coordinator, Career and Technical Education, Milwaukee Public Schools (bakerlc@milwaukee.k12.wi.us)
- Tricia Berry, Past President, Women in Engineering Proactive Network (tsberry@mail.utexas.edu, <http://www.engr.utexas.edu> & <http://www.wepan.org>)
- Jessica Bullock, Recruitment Manager, Francis Tuttle Technology Center (jbullock@francistuttle.edu , www.francistuttle.edu)
- Randy Freedman, Outreach Manager, Society of Women Engineers (randy.freedman@swe.org , www.swe.org/aspire)
- Fatima Goss Graves, VP for Education and Employment, National Women’s Law Center (fgresses@nwlc.org, www.nwlc.org)
- Catherine Hill, Director of Research, AAUW (hillc@aauw.org, www.aauw.org)
- Linda Kekelis, Director, Techbridge, Chabot Science & Space Center (lkekelis@gmail.com, <http://techbridgegirls.org>)
- Stephanie Bicoulis Lemnios, STEM Education Consultant (sblemnios@gmail.com)
- Lisa Maatz, Chair, National Coalition for Women and Girls in Education (NCWGE), STEM Taskforce (maatz@aauw.org)
- Laura Huerta Migus, Director, Equity & Diversity, Association of Science-Technology Center (ASTC) (lhuertamigus@astz.org)
- Kate L. Pickle, National Program Manager, STEM, Girl Scouts of the U.S.A (kpickle@girlscouts.org, www.girlsouts.org)
- Brenda Stegall, Director of Program and Training Services, Girls Inc. (bstegall@girlsinc.org, www.girlsinc.org)
- Listening Panel
- Laura Adolphie, DOD (Department of Defense)
- Irnande Altama, OSTP (Office of Science and Technology Policy)
- Jordyn Champman, OSTP
- Rebecca Daily, State Department
- Jessie DeAro, OSTP
- Kitty Didion, NAS (National Academy of Sciences)
- Patricia Falcone, OSTP
- Kumar Garg, OSTP
- Jolene Jesse, NSF (National Science Foundation)
- Sarah Stewart Johnson, OSTP
- Rebecca Keiser, NASA
- Michael Lamb, Department of Education

Shirley Malcolm, AAAS (American Association for the Advancement of Science)
Sharon Pearce, Girl Scouts of the USA
Jason Rao, OSTP
Steve Robinson, DPC (Domestic Policy Council)
Kate Russell, State Department
Erin Szulman, OSTP

OVERALL RANKING OF STRATEGIES FROM COMMUNITY INPUT (after Round 2)

Topic	Count N=227	Percent
Provide training for teachers of STEM-related courses on new instructional strategies that focus on equitable and “hands-on” methods . (These strategies focus on virtual and hands-on activities, technology or other content, emphasize real-life problem solving, and include types of learning that work better for girls.)	171	75%
Provide training for school counselors on the changing composition of the workforce and opportunities in STEM careers. (Focused on encouraging counselors to provide a greater intensity of recruitment to STEM careers; feature both genders in work and accomplishments; provide more career guidance to both girls and boys; provide information about high-wage, high-skill jobs for women; make societal benefits known; and address the influence of peers in career choice, especially the choice of nontraditional STEM careers.)	145	64%
Provide training for teachers of STEM-related courses on new classroom interaction strategies shown to motivate students, especially girls , to choose to study STEM subjects. (These strategies take into account research on girls’ aspirations, self-perception of ability, stereotypes, self-efficacy, etc. – factors that affect motivation and confidence.)	130	57%
Cultivate the collaboration between various efforts through periodic, regional coordination “summits” in order to leverage work that has been done or is underway. Exchange information, invite new players and investors, recognize and promote success. Enable cross-promotion and teaming. Facilitate interfaces between formal and informal education communities and interests. (The goal is greater efficiency and effectiveness through organization and collaboration.)	95	42%
Support a national clearinghouse on research, best practices, materials, organizations, and experts on girls and STEM education. Make it easier to leverage work that has been done or is underway. Provide simple summaries for new entrants to the topic. (The field is missing a comprehensive digital library and macro-guidance with sustained funding and a mandate with a wide scope.)	94	41%
Support TV programs that spark interest in STEM subjects and counter stereotypes about who does science, how much fun it is, and careers. (These programs would incorporate research on factors that affect motivation and confidence, especially in girls.)	74	33%
Engage underrepresented groups by providing programs and activities customized for groups of certain ethnicity and/or socio-economic characteristics , such as Hispanic boys, African American boys, Hispanic girls, inner city children and rural children.	65	29%
Showcase positive role models and expose students to role models and mentors . (Invite speakers and visitors from local industries to schools. Take students on visits to work sites with jobs in STEM fields.)	64	28%
Have schools invest more to invite, involve, and educate parents about the study of STEM subjects, and career opportunities.	60	26%
Design activities that involve parents and families in learning STEM content, and in learning about careers. (Support early career planning with parents.)	56	25%
TOP TEN		
Provide tools for assessing the equity climate in schools , particularly in STEM subjects. (Provide tools and approaches for more inclusive hiring; schedule students in nontraditional programs in cohorts whenever possible; provide support services and in-school STEM clubs and activities.)	55	24%
Provide training for museum, after-school providers, and girl-serving organizations (with a focus on STEM) that explain new interactive educational strategies shown to engage students, especially girls, to choose to study STEM subjects. (These take into account research on girls’ aspirations, self-perception of ability, stereotypes, etc. – factors that affect motivation and confidence.)	54	24%
Provide guidance on engineering and technology learning and girls aimed at elementary and middle school levels.	43	19%
Make taking math and science courses a requirement in high school.	43	19%
Provide guidance on mathematics learning and girls aimed at elementary and middle school levels.	42	19%
Provide mentoring relationships between students and professionals in STEM fields. (Train the mentors and mentees in the concept. Especially match girls with women in nontraditional STEM careers if possible.)	41	18%

Topic	Count N=227	Percent
Provide computer science and technology camps, after-school programs, clubs, and weekend programs for girls at elementary and middle school levels.	40	18%
Provide guidance on science learning and girls aimed at elementary and middle school levels.	38	17%
Provide information, tools and other support to media companies about how they portray scientists and engineers . (Encourage them to provide positive role models, emphasize educational preparation pathways, and generally present women in nontraditional STEM careers in a positive light.)	38	17%
Provide training for museum, after-school providers, and girl-serving organizations (with focus on STEM) on equitable and “hands-on” methods . (These methods focus on new instructional strategies, virtual and hands-on activities, technology or other content; emphasize real-life problem solving and include types of learning that work better for girls.)	37	16%
TOP TWENTY		
Encourage informal education programs to utilize developed TV programs on STEM subjects (and girls, ideally) as the focus of content. (e.g., museum, after-school, clubs, or summer camps).	31	14%
Develop better career guidance materials that encourage students to pursue nontraditional STEM careers. (Address issues that particularly worry girls, such as work-life balance.)	30	13%
Provide math camps, after-school programs, clubs, and weekend programs for girls at elementary and middle school levels.	30	13%
Produce a critique about the way the media portray technical education and nontraditional STEM careers . (Survey current programs, incidents, Internet content and highlight positive examples.)	25	11%
Provide science camps, after-school programs, clubs, and weekend programs for girls at elementary and middle school levels.	23	10%
Increase awareness and enforcement of civil rights and sexual harassment policies and practices, and the applicability of Title IX to STEM education.	22	10%
Provide guidance on engineering and technology learning and girls aimed at the high school level.	21	9%
Identify and promote video games that appeal to girls at all ages.	21	9%
Provide tutoring, child care, transportation, and tuition assistance to students enrolled in nontraditional career and technical education programs at the secondary and post-secondary level.	19	8%
Encourage in-school clubs for students interested in nontraditional STEM fields.	18	8%
Make taking technology and engineering courses a requirement in high school .	15	7%
Correct bias in curricular and professional development materials .	13	6%
Create student incentives for taking AP courses in STEM subjects in high school .	11	5%
Provide guidance on mathematics learning and girls aimed at the high school level.	10	4%
Provide a high school curriculum module on visual-spatial skills .	9	4%
Provide math camps, after-school programs, clubs, and weekend programs for girls at the high school level.	9	4%
Provide computer science and technology camps, after-school programs, clubs, and weekend programs for girls at the high school level.	9	4%
Provide guidance on science learning and girls aimed at the high school level.	7	3%
Provide science camps, after-school programs, clubs, and weekend programs for girls at the high school level.	6	3%

RANKING BY MEETING PARTICIPANTS

	Rank Before Meeting Count N=13	%	Top 10 per Crowd N=227	Top 11-20 per Crowd	FINAL N=15
Provide training for teachers of STEM-related courses on new classroom interaction strategies shown to motivate students, especially girls, to choose to study STEM subjects. <i>(These strategies take into account research on girls' aspirations, self-perception of ability, stereotypes, self-efficacy, etc. – factors that affect motivation and confidence.)</i>	8	62%			13
Showcase positive role models and expose students to role models and mentors . (Invite speakers and visitors from local industries to schools. Take students on visits to work sites with jobs in STEM fields.)	4	31%			12
Provide training for teachers of STEM-related courses on new instructional strategies that focus on equitable and “hands-on” methods. <i>(These strategies focus on virtual and hands-on activities, technology or other content, emphasize real-life problem solving, and include types of learning that work better for girls.)</i>	7	54%			10
Cultivate the collaboration between various efforts through periodic, regional coordination “summits” in order to leverage work that has been done or is underway. Exchange information, invite new players and investors, recognize and promote success. Enable cross-promotion and teaming. Facilitate interfaces between formal and informal education communities and interests. (The goal is greater efficiency and effectiveness through organization and collaboration.)	6	46%			9
Support TV programs that spark interest in STEM subjects and counter stereotypes about who does science, how much fun it is, and careers. (These programs would incorporate research on factors that affect motivation and confidence, especially in girls.)	3	23%			9
TOP FIVE STRATEGIES CUTOFF					
Provide training for school counselors on the changing composition of the workforce and opportunities in STEM careers. (Focused on encouraging counselors to provide a greater intensity of recruitment to STEM careers; feature both genders in work and accomplishments; provide more career guidance to both girls and boys; provide information about high-wage, high-skill jobs for women; make societal benefits known; and address the influence of peers in career choice, especially the choice of nontraditional STEM careers.)	7	54%			8
Have schools invest more to invite, involve, and educate parents about the study of STEM subjects, and career opportunities.	6	46%			8
Support a national clearinghouse on research, best practices, materials, organizations, and experts on girls and STEM education. Make it easier to leverage work that has been done or is underway. Provide simple summaries for new entrants to the topic. (The field is missing a comprehensive digital library and macro-guidance with sustained funding and a mandate with a wide scope.)	5	38%			5
Engage underrepresented groups by providing programs and activities customized for groups of certain ethnicity and/or socio-economic characteristics , such as Hispanic boys, African American boys, Hispanic girls, inner city children and rural children.	3	23%			5
Provide tools for assessing the equity climate in schools , particularly in STEM subjects. (Provide tools and approaches for more inclusive hiring; schedule students in nontraditional programs in cohorts whenever possible; provide support services and in-school STEM clubs and activities.)	5	38%			

Provide mentoring relationships between students and professionals in STEM fields. (Train the mentors and mentees in the concept. Especially match girls with women in nontraditional STEM careers if possible.)	4	31%			
Provide training for museum, after-school providers, and girl-serving organizations (with a focus on STEM) that explain new interactive educational strategies shown to engage students, especially girls, to choose to study STEM subjects. (These take into account research on girls' aspirations, self-perception of ability, stereotypes, etc. – factors that affect motivation and confidence.)	3	23%			
Provide computer science and technology camps, after-school programs, clubs, and weekend programs for girls at elementary and middle school levels.	3	23%			
Provide guidance on mathematics learning and girls aimed at elementary and middle school levels.	2	15%			
Provide guidance on engineering and technology learning and girls aimed at elementary and middle school levels.	2	15%			
Provide guidance on science learning and girls aimed at elementary and middle school levels.	2	15%			
Design activities that involve parents and families in learning STEM content, and in learning about careers. (Support early career planning with parents.)	2	15%			
Encourage informal education programs to utilize developed TV programs on STEM subjects (and girls, ideally) as the focus of content. (e.g., museum, after-school, clubs, or summer camps).	2	15%			
Make taking math and science courses a requirement in high school .	1	8%			
Provide information, tools and other support to media companies about how they portray scientists and engineers. (Encourage them to provide positive role models, emphasize educational preparation pathways, and generally present women in nontraditional STEM careers in a positive light.)	1	8%			
Provide training for museum, after-school providers, and girl-serving organizations (with focus on STEM) on equitable and “hands-on” methods . (These methods focus on new instructional strategies, virtual and hands-on activities, technology or other content; emphasize real-life problem solving and include types of learning that work better for girls.)	1	8%			
Provide math camps, after-school programs, clubs, and weekend programs for girls at elementary and middle school levels.	1	8%			
Produce a critique about the way the media portray technical education and nontraditional STEM careers. (Survey current programs, incidents, Internet content and highlight positive examples.)	1	8%			
Increase awareness and enforcement of civil rights and sexual harassment policies and practices, and the applicability of Title IX to STEM education.	1	8%			
Identify and promote video games that appeal to girls at all ages.	1	8%			
Provide tutoring, child care, transportation, and tuition assistance to students enrolled in nontraditional career and technical education programs at the secondary and post-secondary level.	1	8%			
Encourage in-school clubs for students interested in nontraditional STEM fields.	1	8%			
Provide guidance on engineering and technology learning and girls aimed at the high school level.	0	0%			
Provide guidance on mathematics learning and girls aimed at the high school level.	0	0%			
Provide guidance on science learning and girls aimed at the high school level.	0	0%			

Develop better career guidance materials that encourage students to pursue nontraditional STEM careers. (Address issues that particularly worry girls, such as work-life balance.)	0	0%			
Create student incentives for taking AP courses in STEM subjects in high school .	0	0%			
Make taking technology and engineering courses a requirement in high school .	0	0%			
Provide a high school curriculum module on visual-spatial skills .	0	0%			
Correct bias in curricular and professional development materials .	0	0%			
Provide math camps, after-school programs, clubs, and weekend programs for girls at the high school level.	0	0%			
Provide science camps, after-school programs, clubs, and weekend programs for girls at elementary and middle school levels.	0	0%			
Provide science camps, after-school programs, clubs, and weekend programs for girls at the high school level.	0	0%			
Provide computer science and technology camps, after-school programs, clubs, and weekend programs for girls at the high school level.	0	0%			

COMMUNITY INPUT VIA ELECTRONIC BRAINSTORMING

About 350 individuals in the community helped prioritize the recommendations via an open invitation that reached over 8000 people, with very short notice. Many (273) consented to have their names listed.

The list of contributors shows a very diverse group, in terms of their roles in the community of practice, affiliations, and geographic spread. There are scientists, directors of professional associations, education research and evaluation experts, public school teachers, STEM faculty, leaders of educational non-profits, and professional scientists and engineers in industry. They all cared enough to respond quickly; they constitute our “crowd source.”

The full list is attached to the Memo and not repeated here.

COMMENTS SUBMITTED VIA COMMUNITY BRAINSTORMING

Those participating in the electronic brainstorming had the option to make comments and suggestions for additional strategies.

- 1. Train and promotion of the concept that there are multiple ways to think scientifically - the male based linear versus the female-based circular thinking for example. Both are valid.
- 2. More collaboration between the arts (visual, written, or performance) and STEM fields. This would help with the creative concepts, help with the image of STEM professionals as something other than white coated geeks and promote the integration and application of all knowledge.
- 3. Promote the application of STEM to sustainability - new fuels, remediation, etc.
- 4. Increased funding for STEM graduate programs.
- Active engagement of college females in programs - especially stipends to support their outreach and engagement with younger females.
- Basics of mathematics and science at early age - preschool and elementary
- Connect local industry professionals to educators for current knowledge and skill transfer
- Corporate partnerships which engage science, technology and other companies with girls and underserved populations in their work, career opportunities and role modeling.
- Demystify what is engineering
- Dual enrollment programs can help boost a student's progression. Even if the dual credit is not in a math or science, this will still enable a lighter academic load in college.
- Encourage partnering between K-12 and nearby colleges and universities that can provide interesting "field trip" destinations and encounters with female STEM students.
- Find ways to portray STEM careers in a more gender neutral (non-masculinized) way that appeals to girls who may be more traditional in their gender role orientations.
- Given the emphasis in the survey on girls, be sure that this effort does not end up focusing on white girls from middle-income and wealthy families.
- Group summer travel to national parks and other areas of science interest for girls who could never afford this.
- Guidance to teachers on integration of STEM subject/content areas from elementary thru secondary school. Not only the science/math and the technology/engineering combo but allowing students, parents, and business community increased understanding/appreciation of the STEM required/implemented in daily living skills e.g. preparing a bowl of cereal with milk (process that can be used with Pre-K to postsecondary - depending on curriculum and subject)
- Have STEM Fraternities, sponsored and led by industry representatives as advisors.
- I do not think the instructional strategies have to be "new" if they are proven effective. Under "focus on schools", role models and mentors should be women and people of color. Ideally, they should be trained on messages that will resonate with girls and not turn them off.
- I thought this was an extremely thorough survey. One more, is to help school districts place STEM education for girls as a priority. They have so many problems and the teachers are already so stretched. In addition, in these difficult budget times, many of our technology teachers have been let go and 30 percent of our high schools in a hard city school district have been completely cut out. That is why providing outreach to girls is especially important, if no technology education is present. One assumes technology education is happening in every school, and it is not. School districts need to be accountable for keeping up with the times and educating kids for the 21st century work force.
- I suggest we should be able to pick more high priorities, because 5 was not enough. I suggest 10, and work our way down. For example, I would have picked at least one from each category, so maybe we have a chance to do that? I would have picked educating teachers, but school districts come first, because if there are no teachers there, it's the school districts priorities. Some schools, more than you might think, do not even think about technology education as relevant! And CTE is a dirty word, and not in the strategic plan! Priorities must be examined.
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- I'd like to see support for collaborations where a community encourages multi-generational learning for girls and women.
- In this economy, funding these services and following up with the application and quality afterwards is VERY important. A considerable amount of the opportunities listed here have been around and done for decades. They are sporadic and based on a unique site access vs. overall, county/district-wide programming.
- Teachers who are vigorously vested in gender equity (for females and males) remain rare. More schools are separating the genders, in middle schools, without meaningful staff and parent training. Schools don't even "tell" the kids the reasoning-other than implying its behavior (and due to "uncontrollable" hormones...)
- Incentivize business and professional engineers to establish internship and mentoring programs to expose more students to the professional work environments. Provide multiple career options to better inform students the breadth of STEM related fields.
- Incorporating technology learning into non science/math classes. Research shows that it is increasingly important to take these lessons to where the girls already are rather than only encouraging girls to take classes they don't currently take.
- Increase coordination of girl-inviting STEM activities at the local and state level by organizing "showcases" of current activities/programs.
- Increase seat time (longer days, more days per week, more days per year).
- Increase pay bonus incentives for teachers of STEM fields with student achievement data driven levels of bonus structure.
- Increase collaboration and prep time available for STEM teachers for necessary planning and preparation to implement research and student data driven strategies.
- Larger cultural change to empower girls in all areas including hands-on technology.
- Making students good communicators of their science findings. Leadership skills for students to make them future leaders in STEM - have them look for hero among the STEM community.
- Many of the activities above are very effective in increasing interest and even skills, but not much is included on offering students examples of how to get from here to there (STEM major in college). While mentoring and parental participation may provide some of that, first generation and under-represented students in particular need to have experiences that occur on campuses with direct involvement of STEM faculty and STEM students - these encounters make the goal at the end of such paths tangible.
- More male elementary school teachers - I don't think the overall impact (on either girls and boys) of the low participation rate of men in elementary education has been adequately examined, and particularly not with regard to STEM education. (My first undergraduate degree was elementary education, and my second undergraduate degree was mechanical engineering.)
- Provide infrastructure to foster interaction among girls in different countries interested in STEM activities/careers
- Get tech companies to partner with schools, providing speakers as role models, have students visit the sites, etc.
- Provide resources to support engineering science, engineering technology, and computer science learning communities at community colleges; resources to support STEM clubs at community colleges.
- Provide stipends to support intern/apprenticeships for high school students in a STEM field.
- Provide training for administrators and other instructional leaders on implementing STEM into the school curriculum.
- Provide training to pre-service teachers on what is engineering and how it is exciting and accessible to everyone (including them) so they can spread the word in their 5-day a week 6 hours per day contact with the students, and make sure they have a POSITIVE attitude and don't give the impression that STEM topics are scary and difficult.
- Regarding teachers, we can make improvements in the teacher prep process at universities that help pre-service teachers understand some of the messages and culture shaping they are doing in their classrooms.
- Require math and science instructors in high schools to have related degrees.
- Encourage math and science instructors to connect with STEM industries through mentorships or externships. This could focus them and then their curricula on workforce needs, plus provide them with funding to update equipment and software to STEM classrooms.

- Shadowing can be very effective in encouraging STEM among women.
- STEM is too broad a topic - let's drill down and get specific on disciplines that matter to innovation.
- Study Richard Pausch's "Fake Head" - the philosophy used to develop Alice 2.0, A tool aimed at girls to teach them the JAVA programming language. We need more of these types of tools for all the science, math, and engineering disciplines.
- Incorporate math education into physics, the way it occurs naturally. Promote inquiry-based teaching methods in science all the way down to kindergarten.
- Support collaboration with computer industry to highlight the real need for contributions from under-represented populations.
- Support efforts to provide courses that can be included in standard curriculum at the high school level, doing the things mentioned above while introducing computational thinking.
- Support the linkage between Digital Media Literacy (Jenkins, MacArthur, etc.) and STEM Literacy.
- Develop new and better assessments of complex skills.
- The most important thing is pushing women to TEACH in this area so that girls see it from the beginning. I also like the idea of making engineering, science, and math mandatory for high school students. I think all students should get a variety in their education to make choices that are more informed.
- We must increase the engagement of girls and young women in STEM education and careers. The group most at risk of not succeeding in school and gaining access to STEM careers, however, is young African American and Latino males.
- We need a plan to support under-represented students financially, emotionally, and academically as they mature from child to adult in their early college years. We lose too many who are not ready because we do not help them.
- We need to recognize that only a certain percentage of female students (and male) have the aptitude to pursue STEM. We need to focus our resources on the ones that have a high likelihood to get the biggest bang for the buck.
- What is the goal? If the goal is to INCREASE the number and interest of students (both male and female) in science then it MUST begin in Kindergarten, not in middle or high school. Research shows that 64% of students make up their mind whether they like science by 11 years old! Elementary school teachers are not prepared to teach science. Forget about hands-on investigations in science, 80% of elementary teachers "have no clue".
- After school programs, clubs, etc. are just preaching to the converted. You make "better" students, but you will not effectively get more students interested. These programs do not reach the audience you should be going after- the students that aren't sure about STEM yet.
- Work to close the STEM gap in education and careers for girls from under-represented racial and ethnic groups.
- Learn from other countries that do better than we do in STEM how to increase the participation of girls in STEM education and careers
- Work with Title IX coordinators to provide accountability information on participation in STEM and to increase the use of gender equity strategies in STEM.
- A lot is known about what supports women and members of other under-represented groups interest in STEM. Attention needs to given to building coalitions to promote change in policy and to generate resources.
- A national clearinghouse is already in existence - NCWIT focusing on IT careers and the WEPAN Knowledge Center focusing on women and girls in STEM. Rather than create yet another clearinghouse, we should focus on supporting these.
- All of these are extremely important! Subgroups need to be selected to focus on the various aspects
- Attitudes are slow to change. Guidance counselors tend to stereotype students and close doors for them.
- Camps and special programs after school might make girls who typically have a wide range of interests feel like they cannot compete with those that participate in these programs.
- Create a speaker bank of willing professional women in Engineering, Math and Computer Science who are REALLY good speakers, and fund their outreach activities in schools.
- Create leadership curriculum to compliment STEM curriculum. Develop leadership skills increases level of responsibility, confidence, commitment to others, and overall desire for excellence.

- Do not enforce gendered stereotypes, create backlash for girls, or create push-back from girls by making these too girl-centered----increase opportunity for all, with an emphasis on girls' needs.
- For STEM education, we must focus on the areas that are most "broken", namely elementary school.
 - 1) Colleges MUST require 9 hours of real science (including labs) for ALL elementary teachers!!!
 - 2) Current teachers MUST learn what hands-on inquiry based learning is all about.
 - 3) School districts MUST make STEM a focus from Kindergarten to graduation, not just middle and high school. Science learning does NOT begin in 4th grade; it begins in Kindergarten.
 - 4) Standardized testing cannot "test" imagination based learning, yet humans use imagination based learning 90+% of time to learn something new. The focus needs to be on learning, not testing.
 - 5) Elementary schools need to give additional time to STEM learning. In elementary school, children spend less than 2 hours a week on science learning, where other countries are spending 6+ hours per week on science.
- Girls Inc. of Chattanooga is in the process of developing a nationally unique venue for teaching girls about engineering and technology at a Center to be opened in late 2011. The center has been in the planning stages since 2008.
- I am interested in helping this initiative. Please establish workforces in various states that volunteers can join, to help launch this effort. Most recently, I have collaborated with post-secondary to write grant proposals to train automotive teachers in hybrid and vehicle electrification; and a grant to train construction and HVAC teachers to be Certified Energy Auditors. The teachers represent both genders and diverse cultures; with a continued need for more female representation.
- I think a crucial focus must be on the disparity between high income and high achieving students (girls) and their sister/cousins in urban/low income environs. Certainly many more high achieving dominant culture females are using science success to go into medicine but what about the "rest of the girls." We need to target struggling students in urban districts to real yank on the paradigm. Looking forward to the results...
- I think we can utilize web resources more effectively to leverage some of these very important issues.
- I was a little unclear on what "provide guidance related to...." really meant in the first category of strategies. Rather vague on what that actually means so a little difficult to weigh in accurately.
- I was happy to see "Provide tutoring, CHILD CARE, transportation, and tuition assistance to students enrolled in nontraditional career and technical education programs at the secondary and post-secondary level" listed as a choice. We also need to have support with childcare at the proposed periodic, regional coordination "summits", and (even an informal) ability to match people interested in sharing transportation or accommodation for summits and conferences, so we encourage smaller organization and people at the beginning of their career to participate.
- Intentional partnering with industry leaders regarding preparing future workers with technology skills would be a win-win and provide possible sustained financing versus grants with limited timelines.
- It is almost impossible to choose a top 5, since they are all of utmost importance.
- This was very hard to do. It all needs doing. Also, if we find success, how can we support that program among ourselves that seems to be a stumbling block. If we work together, we would be much more formidable. And how can we promote a successful program? If we see it works, and make sure these efforts continue? Rally around people who work at these efforts. It can be very lonely, and hard, we need more support and in real terms, such as letter writing, go to top level meetings with school districts, I can name more. School districts do not see this work as valuable or important, and it's not at all protected. So we need to support the people going out on a limb and making it happen. I would have also picked as a high priority that all students, girls especially, have to take some technology classes in high school. The percentage of girls in technology in high school is alarming. No matter what kind of classes a school has we can make sure girls know about these careers and have been exposed to them with mentoring and all sorts of ways. The reason I bring this up is because school districts are the major source of the problems. I see columns that mention teachers and counselors, but the decisions start higher up.
- It was at times difficult to answer the survey. Although I may have thought an item was a top priority in general - I did not think it a top priority for investment in the Educate to Innovate Campaign. I hope the answers will not be used for anything other than as an evaluation of importance of investment in the Educate to Innovate Campaign.

- Looking forward to the results of this survey
- Make STEM fun! Integrate into all content areas; Inform/Involve parents in their child's career planning - start in elementary/middle school; Info/Involve parents in understanding of job projected for metro; Inform/involve students e.g. positive role models in non-trad careers; thanks for allowing us to provide input
- Our state is involved in a 5year planning process around STEM education and careers and the Governor's Advisory Council is doing a great deal of work which covers all the topics listed in the survey.
- Most of these questions suggest that "you" are still thinking of STEM as individual components (math, science...) when STEM needs to be an integrated, transdisciplinary approach. Yes, it is harder and takes more work but until we approach and deliver STEM differently than we are really just teaching the same old things under a new name and fighting over the dollars too.
- My experience is that the material/research/best practices are well defined and well developed. The problem is getting that information into the hands of the practitioners--the teachers, guidance counselors etc, who impact girls directly.
- No STEM programs should be restricted to girls and women or boys and men as this is a likely violation of Title IX. Do not assume that there are sex differences in how students learn STEM.
- Our program begins in elementary school and works to sustain the interest of pursuing a career in a STEM field.
- Parents are critical to the educational and career development process, as are early career intervention strategies. The idea of change in thought or action creates fear - fear of the unknown. We must make known the advantages of STEM careers to the future prosperity of our children.
- Please push the interdisciplinary aspects. I am so frustrated by the narrow mindedness of many people in STEM fields. I tried working with an environmental engineer on a project and was dismissed because I was "only a microbiologist". Until those walls between the fields come down, we will not make progress.
- Re: critique -- as long as it is written in a way that is accessible (that is, avoiding academic jargon) and disseminated in ways that really get the critique in front of people who can make policy decisions.
- Thanks for hosting and analyzing this!!
- See also R. Miller and E. H. Barney Smith, "Education by Design: Connecting Engineering and Elementary Education," Proceedings Hawaii International Conference on Education, Honolulu, HI, January 2006. E. H. Barney Smith and R. Miller, "Engineering for Educators," Proceedings ASEE Annual Conference, Portland, OR, June 2005, paper #9259.
- Some video games targeting girls focus on Barbie/fashion and are not helpful. Girls Inc. has a great spatial logic game called Team-Up. Please check it out!
- Also, camps and afterschool programs should involve mentors and educate parents, but I could not include in my top 5.
- Thank you for the opportunity to address this important topic!
- The "Provide guidance on..." statements under Focus on Teachers were ambiguous to me, therefore I wasn't able to rate them highly.
- The administrative support is very important to the implementation of STEM activities. Therefore, they must receive knowledge and training of STEM. I know that females are the underrepresented minority, but what about the other underrepresented minorities and an increase in their participation in STEM careers.
- The application of the concept is new and therefore, requires clear understanding of its practical usage e.g. whether the STEM competency would ensure better job opportunities without pursuing higher education is a factor that would encourage the students and the community to be more interested. Although, STEM applies to the USA education system its implication is global specifically in terms of overseas students applying for higher education in US colleges therefore, the process needs to engage education sectors of Europe, Asia and Africa.
- The most powerful effect on my female undergraduate students has been working with underserved girls. This was an unanticipated outcome - the female UGs have so much more confidence after leading the programs.
- The steps that are taken need to incorporate fun for the students. It doesn't matter if the guest speaker is a world renowned engineering who has discovered something that will change the world as we know it. If they are not engaging and fun the students will want to follow into any STEM fields of study.
- The two suggestions for ways to "focus on counselors" were very frustrating for me to read. This is exactly the same 'initiative' that was going on for counselors when I was a student in the 1970's and 80's. Perhaps we need

to go beyond providing counselors with information and instead provide training and opportunities for the counselors to give students more realistic experiences with STEM careers and STEM leaders in their communities? I don't think giving every guidance counselor in the country another brochure which says the number of girl engineers is going up would result in a single non-stem bound girl becoming stem bound.

- For teachers (especially high school), how about summer internships for educators doing science with a woman scientist? Teachers who have done science research are better at teaching it. Having a local scientist as a role model not only would provide the teacher with support, it would provide a concrete example that science happens within the students' own community.
- This is very difficult to answer... Of course all of these items would be a benefit.
- This whole process needs to grow much larger than it is right now. Too few educators, parents, industry partners are involved. I will help.
- We need to provide more than the medical field as options. Look at the interest in forensics. That is totally TV based and portrays the career as sexy, work-intense, emotional-tortured and personal relationships suffer - why are girls interested?
- You totally missed it with the counselors' questions. The counselors I deal with are doing the best they can. Improve discipline in the classroom and let the counselors do their jobs rather than being the disciplinarians for the campus.