The 'Ick' Factor:

Do Gender or Ethnicity Drive STEM Choices?

The academic choices being made by girls and minorities show that schools need to do more to promote STEM careers and learning opportunities.

BY LAURA REASONER JONES

I AM STANDING IN MY COMPUTER LAB, TALKING WITH THE FIFTH- AND SIXTH-GRADERS COMING IN FOR Lab Lunch, my voluntary enrichment program. Two students have begun working on the work-in-progress, the K'NEX Loopin' Lizard. Odalys, a young Hispanic girl with improving English, shyly comes up and asks me, "Why you have a boy toy here?"

I am stunned. K'NEX is a boy toy? Have we made no progress in the 40-plus years of fighting for gender equity?

I think about the kids who come to Lab Lunch. They are presented with a wide variety of options: working with photos and movies to create digital-media productions, learning object-oriented programming languages such as Scratch and Alice, mapping and building worlds with Google SketchUp and Google Earth, or building thrill rides and bridges with K'NEX. As I look around, I realize that I have a large group of primarily Hispanic children who use only photos and Publisher, a medium-size group of Asian students who jumped madly into the programming, a large group of boys working with Google programs, and the rest pretty equally spread out among the options. It is exactly what happened 15 years ago when I started working on technology and gender issues: The girls who had never touched tools or Legos or K'NEX hung back; the girls with big brothers or enlightened parents dove right in. But now, it is also divided by ethnicity.

My school is diverse, with more than 40 percent of the students below federal poverty lines, 46 different home languages, and no ethnic majority. The world has changed, but for Odalys and most of her friends, it is still a divided world, with her culture stating that certain jobs go to men and others to women. For more than reasons of fairness or equity, we need to change their worldview by opening their options in the STEM (science-technology-engineering-mathematics) fields.

Promoting STEM for Everyone

As educators, we must first look at equity. All children have the right to learn and be productive. They also have the right to be exposed to myriad career and educational options.

But we need to look beyond equity. As others have written, we must remember workforce development and economic realities. Fear-mongering about outsourcing aside, STEM field degrees lead to jobs that pay very well and provide economic security for both men and women. But before that, schools must remember that one of our jobs is to help every student leave school with knowledge and skills that will serve her or him well in the future.

Women and minorities must be part of the STEM workplace. I like to think there must have been a female automotive engineer on the design team who had the brilliant idea of sliding doors with remote-control openers on *both* sides of minivans. (Only a mother with young children and groceries could have thought of that.) As Jo Sanders writes in her paper "Lessons I've Learned in 22 Years of Working with Teachers About Girls in IT," there is a difference between using technology and creating it for the rest of us to use. And educators do not seem to make this distinction.

Addressing Gender Issues

As a young woman in college in the early '70s, I witnessed and participated in the loosening of some of the gender and cultural strictures. We saw our younger sisters enter fields that never crossed our radar screens: engineering, law, medicine. We tried to raise our children in less gender-biased environments, buying trains and Legos for our daughters and dolls and kitchens for our sons. We enrolled our daughters for sports we had never

even seen—let alone played—as children.

But as many older educators have noticed, younger teachers and parents feel that gender equity was resolved in the previous decades, and there are no longer any problems. As a result, society seems to have swung back to a pink and blue division. Toy stores label aisles for boys and girls; new toys come out in pink or blue (or pink and camouflage); and advertising and marketing target specific audiences. Stand at any elementary-school bus stop and watch girls with their hot pink Bratz or Disney Princess backpacks and boys carrying camouflage or sports heroes. Even McDonalds gives away two

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different sets of toys in its children's meals. The world has quietly divided again, and it continues to show in the academic choices girls make.

What does this mean for STEM literacy in schools? When girls or underserved minorities come to school with less experience in building toys or tinkering, they participate less enthusiastically in certain school experiences. A cycle begins in which girls or minorities are relegated to acting as note-takers in projects, or being considered as less desirable partners. This group experiences less competence with the raw materials, making the next exposure even more intimidating. Students with lower levels of experience in STEM fields may take fewer risks in class or individual science projects due to fear of failure or just general unease and unfamiliarity with the materials.

Research has shown that what students believe about their academic abilities affects their achievement. When girls or minorities struggle initially with a math or science concept, a belief that intelligence is a fixed trait can only harm them, and can lead to lower self-expectations.

Here's an example: Students drop into my computer lab to work on the K'NEX bridge-building set before school. Edward, a gifted fifth grader, is pushing to finish when Annie, a shy sixth-grader, comes in to help staple papers. I say, "I'll staple these. You help him finish the bridge."

With some prompting, Annie looks at the complex K'NEX directions. Chuyun, a young Asian boy, runs in, and he and Edward plunge ahead on the bridge, ignoring the directions. Annie steps back from the table. Edward and Chuyun do not respond to my prompts to tell Annie where they are in the instruction book; instead, they rush ahead fearlessly.

When girls or underserved minorities come to school with less experience in building toys or tinkering, they participate less in certain school experiences.

Danielle, an African American sixth-grader, runs in, having seen the progress from the hallway.

Annie quickly moves back to my desk, saying she'll finish the stapling. I say, "No, you all go and work. Let's see if we can finish this today."

Danielle looks at Annie and asks, "Why aren't you working on the bridge?"

Annie answers, "You have to know how. I might break it."

This is a typical scenario in elementary schools. The girls, with the exception of a few confident ones, hang back and watch, feeling that they cannot get in there and make mistakes or seem incompetent. Then they drift away, intimidated by the boys who tend to act as if they know what they are doing. The problem is compounded for the students who are learning English. It takes a great deal of courage for a student who does not have command of English and has never worked with Legos or K'NEX at home to step into a group of kids and begin to build.

Starting in preK, we need programs and attitude changes to combat the pressures and learned behaviors. We need intentional thinking and planning so that all students can learn and contribute to the STEM fields.

Gender Imbalance in Schools

The Career and Technical Education Schools (CTE) in New York City published a report in January 2008 titled "Blue School, Pink School: Gender Imbalance in New York City CTE High Schools." This report addresses the significant imbalance of gender distribution in the 18 NYC technical high schools and makes recommendations to address this problem.

While enrollment in these high schools is 59 percent male, six of the 18 high schools are over 75 percent male, 11 are more than 55 percent male, and one school is over 75 percent female. The six schools with the greatest male enrollment offer classes and training in aviation, automotive, and construction trades, potentially high-paying careers. The school with the overwhelming female enrollment is the one offering programs in fashion, visual arts, and marketing.

The City of New York is concerned enough about this to make systemic and programmatic recommendations to increase recruitment and retention of female students in traditionally male-dominated fields and to provide more math and science AP classes.

Another large school system outside of Washington, D.C., has made strides in bringing girls into math and science courses, but has a way to go to include minority students. Fall 2007 enrollment for this school system was more than 165,000 students, with 48 percent girls and 52 percent boys. White students comprised 48 percent, Asian students 18 percent, Hispanic students 17 percent, and black students 11 percent of the total. But the range of enrollment in advanced math and science classes at high schools within this system tells a different story.

Minority students and girls are underrepresented in the advanced classes offered to them. In many of the high schools, zero percent of the students in AP math and science classes (e.g., AP calculus, physics, chemistry, and computer science) were black or Hispanic. The highest enrollment of minorities in this district was 16 percent Hispanic students in AP chemistry in one school. In most schools in this system, only around three to five percent of the students in advanced classes are minorities. Girls in these schools are proportionally enrolled in AP biology, but are significantly under-represented in AP physics and chemistry, with many schools having zero to three percent enrollment of women in these classes.

If experience matters, how can we help girls and underserved minorities have the necessary experiences to be comfortable taking the courses to progress in the STEM fields? There are three areas for schools to be concerned with: teacher training, in-school programs, and after-school programs. Model programs have been created for each of these concerns.

Questions for Administrators

1. Review the data for the students in your school. Are girls and under-served minorities enrolled in higher-level math, science, and technology classes? If not, what roadblocks are in their way? What are you going to do about these roadblocks?

2. What after-school programs are available to your students? How are students recruited for these? What roadblocks are present? Are transportation or cost issues keeping students from participating?

3. How are parents involved in helping students make choices about courses that can help or hinder students in their future careers? What can be done to educate parents?

4. Are teachers' attitudes toward girls or minorities holding students back from participation or advancement?

5. What kinds of experiences are you providing for all students so that each child has the experiences needed to build self-confidence?

Teacher Training

Teachers of all grades and subjects need to examine their own beliefs about girls and minorities in STEM fields and take care to engage and encourage these students in effective ways. Simple changes in classrooms can provide more access for these students and change their self-perception. For example, in elementary classrooms, making the classroom computers into centers with assigned times and activities gives girls and English-language learners equal footing with boys to experiment and explore, building confidence. The same is true for other centers, such as blocks and science corners. In addition, getting rid of or at least not reinforcing the "ick" factor is a huge step to help girls maintain their interest in science.

Teachers also can make an effort to help every student become an expert, particularly at using computers. Rather than constantly relying on the boys who come to third grade knowing how to defrag hard drives, teachers should be willing to create opportunities for all students to take responsibility for and learn about the technology tools they use.

Teachers also should be alert to students who have interests or abilities in the STEM fields but may hang back due to unease or unfamiliarity. Opportunities must be made for these students to explore fields of interest in non-threatening venues so that they can build skills and confidence.

In-School STEM Programs

There are many grassroots programs that attempt to address the recruitment and retention of girls and minorities in STEM fields. Magnet schools for science and technology lead the way, but these usually accept only the brightest of students. Other programs reach out to all students. Ohio STEM Learning Network has created a statewide effort to change high schools to meet the needs of the global economy. Students in these programs earn high school and college credit and complete industry internships. Project Lead The Way provides member schools with intensive engineering and technology curricula to teach

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The State of School Science Labs

by Wayne Grant

Research, reports, and high-ranking officials from business and scientific communities have exposed the brutal truth: The lack of focus on science in our schools today will have a devastating impact on the U.S. economy and diminish our competitive edge in the years to come. Our status as the world's foremost innovation nation is in peril.

But take heart! We know what to do. Leading organizations including the National Science Teachers Association, the National Research Council, the National Science Foundation, and the U.S. Department of Education agree that the best way to teach science is through a hands-on approach that stimulates and engages students in real scientific exploration, encourages them to interact thoughtfully with data, requires them to draw conclusions, and helps them formulate cogent explanations for what they have analyzed and concluded. Fortunately, school laboratories were developed to provide just these kinds of experiences. Problem solved?

Unfortunately, it's not that simple. School-lab opportunities today fail in three important ways:

1. Students have limited access to laboratory activities. Though characterized as essential for delivering an authentic science experience, opportunities to do experiments and collect real data are often insufficient—especially in lower grades. According to the National Academies' *America's Lab Report*, high school students enrolled in science classes may spend only one class period per week in the science lab.

2. The poor-quality science experiences most students have in the lab do not deliver the preparation required by leading organizations. *America's Lab Report* concludes that: a) most school lab activities do not help students fully understand science processes, b) the quality of current laboratory experiences is poor for most students, and c) typical laboratory experiences rarely incorporate the kinds of ongoing reflection and discussion that characterize authentic science.

3. School laboratory experiences remain very much out-of-date, relying on old tools, using outdated methods, and focusing on uninteresting issues. Though it's hard to imagine a science today that does not rely on computing technologies, few school laboratories provide access to the digital technologies that are used in 21st-century science practice. The days of doing authentic science with only Bunsen burners and test tubes have long passed.

Science Education in the Future

Computer-mediated science laboratories (e.g., probeware, simulations, animations, and computer model-building) can increase access to authentic inquiry and, therefore, more accurately reflect 21st-century science. Studies comparing the effectiveness of such approaches show that, in most cases, there are no significant and consistent differences in learning outcomes between students doing hands-on activities in a physical lab and those working in online labs. Indeed, a blended approach that combines computer-mediated experiences with hands-on activities may be best of all.

Computer-mediated laboratory activities have many characteristics that could help redress the three failings outlined above. They:

Broaden accessibility. You are not limiting scientific inquiry to dedicated lab spaces, so more students can access real experiments and experience real data.

Use time efficiently. You can integrate lab experiences directly into regular classroom practice, rather than having to move every inquiry experience to a dedicated lab.

Focus on teaching and learning. You spend more time focused on higher-level learning tasks like interpreting graphs because computers can handle lower-level, repetitive tasks, such as drawing axes on graphs.

Expand resources. You can access processes, equipment, and specialized materials not widely available in most schools.

Extend content. You can reinstitute important lab activities removed because of safety concerns.

Deliver multiple perspectives. You can enable students to compare computer models of physical processes or phenomena with their actual behavior as measured empirically.

Deliver multiple representations. You can quickly view data as graphs, meters, tables, or other forms that highlight the most significant aspects of a scientific phenomenon.

Support minds-on science. You can embed prompts and supports for reflection, mental model-building, scientific explanation, and argumentation in computer-based data-collection environments.

Deliver 21st-century science practice. You can use modern tools to deliver modern science experiences.

Without a doubt, science literacy will become a defining factor for individual and national success. Yet, the laboratory approaches in place today do not attract or motivate interest in science. Fortunately, computer-mediated science experiences can help students meet or exceed all the instructional goals of traditional courses. It's time to innovate in science education, using all the tools at our disposal to design and deliver the most important invention imaginable—a bright future for our children. Only through them can we preserve our status as the foremost innovation nation.

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STEM-related Special Interest Groups

Students looking to increase their knowledge and awareness of STEM subjects have a wealth of online resources to support their learning. Many interest groups exist online and provide support, information, and other resources on particular STEM-related topics. While some of the groups highlighted below target specific audiences, others have fewer restrictions on membership and include teachers, parents, and mentors. What they all share is a love and passion for STEM subjects.

BrainCake
www.braincake.org
This Girls, Math & Science Partnership website provides an online community for girls ages 11–17 with interests in math or science, featuring a database of programs and events, numerous activities, an interactive quiz, and GirlTalk Radio, which gives students the opportunity to interview professional women in fields such as ecology. Students, parents, professionals, and teachers can become members.

Engineer Girl!
www.engineergirl.org
This site, from the National Academy of Engineering, offers readings, fun facts, profiles, and other information to encourage girls and young women to pursure an engineering career.

Girls' E-Mentoring Program
www.uic.edu/orgs/gem-set
This site provides online mentoring, supported by the U.S. Department of Education and the Women's Bureau of the Department of Labor, for girls ages 13–18 with interests in science, engineering, and technology. It features a forum for exchanging information on STEM-related topics, such as potential careers, and lists other academic resources, including scholarships, internships, and field trips for students.

***FIRST* LEGO League International**
www.firstlegoleague.org
Combining robotics with research, this international competition for students ages 9–14 promotes interests in science, engineering, and technology while building such important skills as teamwork and problem solving. The website for the program, which is sponsored by FIRST and LEGO, provides features for competitors, including a forum to discuss strategy and design, as well as team tutorials and curricula.

Junior Engineering Technical Society
www.jets.org
This engineering and technology organization for high school students sponsors a variety of competitions and activities and provides access to numerous career resources.

National Society of Black Engineers: Pre-college Initiative
www.nsbe.org/precollege
This program for African American students interested in the STEM fields provides members with information about training, events, and scholarships.

Purdue Science Kids Club
www.science.purdue.edu/sciencekidsclub
Purdue University's site offers club members information on careers in science, help with science-fair projects, and access to games and downloads.

Whyville
b.whyville.net/smmk/nice
To address a loss of interest in math and science during the middle school years, this virtual world allows students to create their own characters that interact with the characters of other students online. Characters play educational science and math games to earn "clams"—the virtual world's currency—that they can then use to purchase goods and services in the virtual world. (*For more on Whyville, see "Virtual Worlds = Real Learning" in the March 2008 issue of* Cable in the Classroom Magazine *at www.ciconline.org/cicmagazine-march08.*)

Zoey's Room
www.zoeysroom.com
Supported by the Platform Shoes Forum, this interactive community for middle school girls features streaming video, message boards, and chat rooms where students can explore their interests in STEM-related subjects. (*For more on Zoey's Room, see the September 2007 issue of* Cable in the Classroom Magazine *at www.ciconline.org/cicmagazine-sept07.*)

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students the math, science, and problem-solving skills necessary to become successful engineers. *(See "Forum," page 18, for comments from Project Lead The Way vice president Richard Blais.)*

Small school systems with limited resources, meanwhile, are investigating the multitude of Web-based resources for students, including the opportunity to take advanced math and science classes not offered in local high schools through online-learning organizations such as Apex Learning and state virtual high schools. Students are no longer limited by the classes offered in their individual schools.

Starting (or retooling) math, science, and technology programs to encourage girls and minorities takes commitment from all levels of instruction. The education-research firm Campbell-Kibler Associates uses a checklist of questions to help administrators determine if there is a problem in their school system and gives recommendations on how to solve the problem.

To begin, school systems must take a close look at enrollment data at all levels, particularly middle and high school classes, and identification processes for gifted and talented classes. If it is determined, as noted in the two examples above, that disproportionate numbers of girls or minority students are being closed out of or avoiding classes that will prepare them for college or careers, action must be taken. Discussions with and training of guidance counselors and teachers is the next step.

Campbell-Kibler then addresses the obvious facts and barriers to overcome in middle and high school, such as scheduling, opening difficult classes to students who are interested but who did not test in the first time around, raising expectations for all students with higher-level classes, creating more math and science electives, and rewarding teachers who inspire students.

Last, Campbell-Kibler suggests that administrators take a hard look at the school climate and the rewards and peer pressure meted out for students who step outside the gender and cultural lines.

Another excellent policy paper on effecting change, "Engagement, Capacity and Continuity: A Trilogy for Student Success," details how programs can have more positive long-term effects on diverse students. The authors suggest that effective programs provide three components for students: engagement (student interest and motivation), capacity (knowledge and skills to advance in the study of science), and continuity (institutional commitment to resources and guidance to support continued student advancement). This analysis gives institutions an excellent model for developing programs that will have positive, long-lasting effects.

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Campbell-Kibler also co-authored a resource for the National Science Foundation on planning programs to increase equity and diversity. Called "Picking the Best," this paper teaches departments to determine what has worked in the past, analyze the issues they are faced with now, and focus the concerns on the students they serve. One example of an action that has worked well is early intervention and identification of students who are interested in math and science. These students can be invited to enrichment programs in and out of school.

Middle and high school guidance programs such as Job Shadowing Day, Take Your Child to Work Day, or Career Day should be given more thought and planning. For students to truly benefit from these days away from school, opportunities should be carefully planned and structured. Most professionals are willing to host a student if requests are made in a timely manner and the student is interested in the job or career.

Science fairs are another excellent gateway to achievement in science. Students who are unsure about science as a discipline can be enticed to investigate an area of their own interest in a rewarding manner. Some students are enticed by the idea of a competition; others may be interested in the exercise alone. In either case, the process of identifying an interest, developing a problem and hypothesis, and testing that hypothesis is a valuable skill for all students.

The Web resource Science Buddies provides a science-project wizard that asks students about their learning styles and interests, then points them to resources that will help them design science-fair projects on those topics.

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Intel's Science Talent Search has awarded top prizes to young women in recent years, with the most recent going to a young woman who analyzed tumor markers for Stage II colon cancer. The 2007 winner also was a young woman. The Siemens Foundation 2007–08 Competition for Math, Science and Technology also was won by young women for the first time in the competition's history. These premier high school science competitions can be goals for young students who are just learning the fun of scientific investigation.

After-School Programs

A great deal of the progress and innovation in the past 20 years has come from after-school programs. From grassroots efforts like northern Virginia's Girls Excelling in Math and Science (GEMS) clubs to national and international efforts such as the Girl Scouts, American Association of University Women (AAUW) programs such as Expanding Your Horizons, and Sally Ride Science, volunteers and interested adults have created

Science-Based Collaboration Projects

Collaborative science projects allow students to interact with a wide range of people—from scientists and researchers to other students in classrooms across the globe—to facilitate learning. The online collaborations profiled below can help students connect not only with these peers and professionals, but also with the natural environment in which they live. Whether tracking the migratory patterns of butterflies or learning the intricacies of the carbon cycle, collaborative science projects can get students engaged in, excited about, and connected to the world and communities that surround them.

Down the Drain

www.k12science.org/curriculum/drainproj

This Center for Innovation in Engineering and Science Education project allows students in grades 4–8 to compare their water consumption with other students both in the U.S. and worldwide. The website has lesson plans for teachers, and students can access all the necessary information to work on the project in the Student Activities section. Students can participate at any time during the year.

Earth Day Groceries Project

www.earthdaybags.org

Usually conducted in accordance with Earth Day but appropriate at any time, this project involves decorating paper bags to promote environmental awareness. After designing their bags, students can share their experiences by documenting them in a report or through posting photos on the website, which keeps a national tally of participating students, schools, and organizations.

EstuaryLIVE

www.estuarylive.org

This National Oceanic and Atmospheric Administration in the Carolinas website allows classrooms to participate in virtual field trips to an estuary in North Carolina through streaming video and direct communication with staff who work to preserve the unique habitat. Students can learn about estuarine ecosystems and the plants and animals that comprise them. Interested students and teachers can use available material or contact staff via a link on the website.

Field Trip Earth

www.fieldtripearth.org/index.xml

North Carolina Zoological Society projects offer students and teachers in grades K–12 the opportunity to interact with researchers in the field through video clips, written materials, and expert interviews. The site features a number of interactive virtual field trips to locations around the globe that offer opportunities to study an equally diverse range of animals.

The GLOBE Program

www.globe.gov

Kindergartners through twelfth-graders can explore the seasons, the carbon cycle, deep-sea environments, and watershed dynamics through four distinct collaborative projects.

The JASON Project

www.jason.org

National Geographic collaborative weather and ecology projects for grades 5–8 provide a number of interactive features, including video clips, images, and 3D games and labs, to help students connect with the subject material.

Journey North

www.learner.org/jnorth

In this Annenberg Media collaborative project, students in grades K–12 track the migratory patterns of different animals from birds to mammals and compare and share them with classmates.

Monarch Watch

www.monarchwatch.org

The Kansas Biological Survey at the University of Kansas' site explores the migration of the monarch butterfly and features examples of collaborative scientist-student projects for students in grades K–6, monarch-related image galleries, and monarch butterfly essays from classrooms around the U.S.

Sea Turtle Migration-Tracking Education Program

www.cccturtle.org/satellitetracking.php

The Caribbean Conservation Corporation & Sea Turtle Survival League site tracks the migration of sea turtles and provides educational resources for use in classroom projects.

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innovative and effective programs directly addressing the involvement of girls and minorities in STEM fields. Partnerships with colleges and universities such as the programs at Center for Women & Information Technology at University of Maryland Baltimore County, as well as multiple conferences sponsored by the Society of Women Engineers, also have proven to be rewarding for students.

I started the GEMS club in 1994 when my then-nine-year-old daughter refused to attend a magnet school because, she said, "Math is hard." This club has been running in her elementary school since 1994 and has spawned the creation of 24 other clubs in our school system. I published my findings in the Virginia Society for Technology in Education's *VSTE Journal* in Spring 2002 as "A Look at Girls' Attitudes toward Math, Science, and Technology. Are We Really Making a Difference?" After six years of the club, I found that girls who were club members in fifth and sixth grades took significantly more difficult math, science, and technology classes in high school than their peers.

Other successful after-school programs include Intel's

Computer Clubhouse, with its specific times and programs for girls; Kidz Online's gURL Tech; and multiple programs offered by the Girl Scouts. These offer site-based programs in selected areas and online resources for distant learners.

AAUW's research report, "Tech-Savvy: Educating Girls in the New Computer Age," was made into a video hosted by Mae Jemison, the first African American female astronaut, and is available for use by school or parent groups to help foster discussions about changing the attitudes and experience of girls in math, science, and technology.

The National Science Foundation has published three directories of grant-funded programs, making these programs replicable and available to other interested parties. These free directories are full of ideas and suggestions for school systems interested in creating new programs.

What Makes STEM Programs Work?

Components of successful in- and after-school programs include:

Teachers or committed adults with passion for the subject: Attitudes of staff in after-school programs carry much more weight than the individual science or technology projects presented.

Long-term commitments: While one-time conferences and events can be inspiring, long-term efforts have more impact on changing lives and attitudes.

Follow-up: Touching base with participants to answer questions or provide guidance can keep kids on track.

Parent education: Helping parents see their girls and minority children as capable of excelling in STEM fields.

Guidance for parents and students in choosing middle and high school classes to ensure that the students have the necessary background knowledge and experiences to achieve in more advanced classes.

Opportunities for girls and minorities to see "people who look like me" (e.g., posters, mentors, and role models) as well as to meet young minority engineers and hear how they beat the odds, struggled to pay for college, and/or overcame math anxiety.

When we make a commitment to help all children, we can make a difference and provide the equal access and secure future all children need to succeed.

Laura Reasoner Jones has been encouraging girls and minorities in STEM fields since 1994, when she started the GEMS clubs. A national board-certified teacher, she created the web-based professional-development tool Digital Edge Learning Interchange for the National Board for Professional Teaching Standards. Currently, she is a school-based technology specialist for Fairfax County (Va.) Public Schools and works with teachers and students to integrate the use of technology into their daily lives.

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