

FURTHERING

Girls' Math Identity



Research Practitioner Partnership Projects

Dr. Nicole Joseph, Vanderbilt University, *Furthering Middle School Black Girls' Math Identity through Mentorship*

Joseph's project seeks to support young Black girls to develop a robust math identity. Through this project, 7th-grade Black girls will have an innovative and interactive experience featuring one-to-one mentoring with Black women mathematicians and mathematics teachers. The project began with adaptation of an existing math identity survey from the *Girls Who Code* program to fit the study's population and mentoring interests, with the goal of constructing and distributing a pre-survey that measures perceptions of math identity and mentoring interest among Black girls.

Leah Oppenheimer, Children's Museum of the East End, *Empowering Latina Girls through Statistical Knowledge*

The Children's Museum of the East End has been providing mathematics, science and technology programs for Latino youth and their families for the past three years. The goal of *Empowering Latina Girls through Statistical Knowledge* is to foster the development of positive mathematics identities of Latina girls ages 10–13 by strengthening their analytical skills and enabling them to better share their views inside and outside the mathematics classroom. A 10-week statistics literacy program will be held for two hours per week. Middle-school girls will read culturally relevant articles, learn how to read and interpret graphs, how to articulate their newly acquired knowledge and how to support arguments using statistics. The program will conclude with a poster or presentation in which participants address their selected topic with supporting statistical evidence from resources such as newspaper articles, government agency reports and other online resources. Implementation began on October 2, 2017, and will end on December 11, 2017.

Sofia Quintero, Girls Inc. of New York City, *Course in Middle School Math for Program Specialists Who Serve as Mentors, Role Models & Tutors*

Girls Inc. is using its mini-grant to create a crash course in middle-school math for program specialists who serve as mentors, role models and tutors for female students. Their theory is that math identity of the girls served by the organization can be improved by first enhancing the math identity of the staff who work most closely with them. One module has been created, with four still to be completed, reviewed and revised by the Girls Inc. Education Specialist. Girls Inc. will also develop an evaluation to determine if the training increases the math identity of staff, and if that increase in turn increases the math identity of girls tutored in Girls Inc. afterschool programs at four middle-school sites. In spring 2018, four program specialists (one per site) will receive training in the curriculum, and the evaluation will be conducted. Girls Inc. is excited about testing the hypothesis, and if proven correct, sharing the curriculum and training with others wishing to further girls' math identity in middle school.

Wamaid Mestey-Borges, *Establishing a Math Circle for Girls of Color in the Washington, DC Metro Area*

Mestey-Borges will launch a Math Circle for girls of color in Washington, DC, in the fall/winter 2017/18. In preparation, she volunteered at the San Francisco Math Circle Summer Camp in 2017 to better understand the challenges and efforts made to include girls and to foster deep and positive math identities; how the presence of women mathematicians creates a critical mass in which girls can envision themselves; and the importance of a physical environment that features photos and bios of women mathematicians and their accomplishments. In addition, she attended the National Math Festival along with mothers of three girls of color who are committed to having their daughters participate in the DC Circle; she reviewed mathematical concepts and made connections with mathematicians who have agreed to participate.

Dr. Susanna Brock, Johns Hopkins University/The Berkeley Carroll School, *Math Workshop Intervention of Supplementary Single-Gender Math Classes*

Susanna Brock's math workshop intervention of supplementary single-gender math classes was completed during the 2016–2017 school year. This mixed method study in a coeducational setting sought to explore the gender gap between high-ability boys and girls in mathematics self-efficacy, sense of belonging and achievement and to provide insights into the potential challenges and benefits of implementing a supplementary all-girls mathematics class in a coeducational school. Three main findings came out of this study: (1) supplementary all-girls mathematics classes may be beneficial for certain populations, and in particular all-girls classes may improve achievement for girls of high mathematics ability and identity; (2) mathematics classes or supplemental math activities that are single-sex may increase middle-school students' sense of belonging regardless of gender; and (3) sense of belonging in girls may have been influenced by the “friend effect”—that is, girls' reported increased confidence and enjoyment when solving mathematics problems with their friends. The results of the first year of the study will be published in the upcoming New England Mathematics Journal and further data collection and analysis is ongoing.

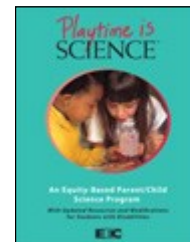
Lorraine Howard, President, Women and Mathematics Education; Wilkes University, *Strengthening Girls' Mathematics Identity and Achievement through Project-Based Learning*

Howard's project seeks to equip middle-school math teachers with the essential principles, tools, procedures and processes for designing, developing, implementing and evaluating effective real-world projects that will transform their students' deeper learning, understanding and retention of the mathematics standards-aligned curriculum, with a focus on girls. The project is taking place with the Neshaminy School District in Eastern Pennsylvania. For the first online course module, a nine-week offering, mathematics teachers, principals, selected academic support staff and the assistant superintendent learned how to set the stage to achieve a high-quality, authentic learning experience and to identify a project. The remaining four modules will be completed in fall 2017 if funding is provided. These modules will provide the full complement of skills and competencies needed for participant-mathematics teachers to begin creating dynamic, technology-rich projects (to be implemented during the spring 2018 term) in which girls can engage in real-world applications of mathematics concepts.

Programs and Materials for STEM Education

Playtime is Science: An Equity-Based Parent/Child Activity Program

Playtime is Science, a hands-on science curriculum for children in grades K-2 is unique in its focus on physical science, strong parent involvement, and accessibility for children with a wide range of disabilities. This standards-based program was designated a Promising Gender Equity Program by the U.S. Department of Education. *Playtime is Science* was pilot and field-tested in New York City schools, and expanded nationally with support from the National Science Foundation.

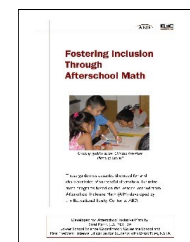


After-School Math PLUS (ASM+)

ASM+ was developed as a collaboration between EEC, after-school centers, and local science museums to increase skills and interest in everyday math. Youth engage in fun, hands-on, real-world math activities and learn how to build exhibits based on their work at a local science museum. An implementation guide and four themes: Jump Rope Math, Built Environment, ArtMath, and MusicMath are included in the ASM+ kit. Each activity contains role models, family and literacy connections, and modifications that make it accessible for students with a broad range of physical, sensory, cognitive, and social/emotional disabilities.

Afterschool Inclusive Math (AIM)

AIM builds on EEC's After-School Math PLUS program. In this partnership between inclusive after-school programs and science/technology museums, youth with and without disabilities worked together on inquiry-based math activities and displayed their work at a culminating event for families. A set of guidelines, "Fostering Inclusion Through Afterschool Math," provides a checklist for an exemplary after-school inclusive math program, and includes lessons learned and management tips. These unique guidelines are downloadable at www.edequity.org.

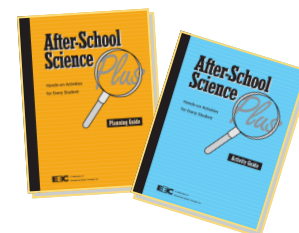


Great Science for Girls (GSG)

GSG worked with ten intermediary sites to build the capacity of afterschool centers to deliver programming that broaden and sustain girls' interest and persistence in science, technology, engineering, and mathematics. GSG provided professional development, on-site consulting services, on-line support systems, and a handbook of best practices. For up-to-date information and resources designed for after-school centers, visit www.greatscienceforgirls.org.

After-School Science PLUS (AS+)

AS+ is an inquiry-based activity program for youth between the ages of 6-14. Ten core activities include diverse role models, career education materials to expand students' views about who does science, literacy connection ideas, family outreach materials in English and Spanish, and resources. The activities use culturally familiar, readily available materials to convey the idea of science as being part of the students' everyday life. An implementation guide geared to the needs of after-school centers provides staff development tools, resources, and parent/family outreach materials.



EEC develops programs and materials that promote bias-free learning in school and after-school settings. We provide professional development, consulting services, and community partnerships. Our goal is to eliminate inequities based on gender, race/ethnicity, disability, and level of family income.

FURTHERING

Girls' Math Identity



FHI 360 – in partnership with the New York Academy of Sciences – is leading a capacity-building project for the National Science Foundation to support the groundwork necessary to advance research and practice on girls' math identity. The project is guided by a diverse planning committee comprised of researchers and practitioners who are thought leaders in the fields of gender identity, STEM identity, math identity, youth development, and teaching and learning. Expanding the research base to explore how we can develop a strong math identity in girls is at the heart of this work. STEM and math identity are two important elements within the larger context of academic identity and achievement.

What is Math Identity?

Mathematics identity refers to a person's beliefs, attitudes, emotions, and dispositions about mathematics and their resulting motivation and approach to learning and using mathematics knowledge (Martin, 2000). It involves the ways students think about themselves in relation to mathematics and the extent to which they have developed a commitment to, are engaged in, and see value in mathematics (Cobb, Gresalfi, & Hodge, 2009). It is through social processes and shared experiences that individuals develop identity and gain a sense of self and meaning (Lave & Wenger, 1991; Boaler & Greeno, 2000). Students learn to engage in practices through communities and develop a sense of self in relation to the practices and communities in which they learn.

What is a NIC?

A Networked Improvement Community (NIC) is an intentionally formed network of educational professionals and practitioners working with researchers to address a practical problem of high importance. The network accelerates the development, testing, and refining of interventions, and then spreads those interventions into a variety of contexts (e.g., in school experiences, informal/out of school experiences, practitioner professional development). The Girls' Math Identity NIC aims to improve middle school girls' math identity as a way to broaden participation in STEM. We are working together to identify what we know and still need to know about how to develop a positive and productive math identity, and how to disseminate that knowledge in the field in order to further research and improve practice.

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FHI 360 and STEM

WHY FHI 360

For more than three decades, FHI 360's STEM team has focused on bringing girls and children and youth from underserved communities into the STEM pipeline. Equity strategies are a core element of our materials, enabling us to drive home the often-overlooked fact that everyone deserves an equal chance to succeed. We base our curricula on research, and we test it in varied settings, making sure it will resonate well in rural and urban settings. Our curricula are easy to implement and cost-effective, ready for use without expensive materials or complicated set-ups and are designed to reach young people anywhere they are, in the classroom or informal settings.



THE GREAT STEM IMBALANCE

STEM (science, technology, engineering, and mathematics) is the future of the economy. STEM-related employment is projected to grow to more than 9 million jobs by 2022, according to the Bureau of Labor Statistics. That's an increase of about 1 million jobs over 2012 employment levels. This is great news for the next generation of workers who will qualify for these jobs, many of which have a median annual wage of nearly \$76,000—more than double the \$35,080 median wage for all workers in May 2013. But it's not such great news for women and other underserved populations who are underrepresented in STEM education and careers. Consider these statistics:

- Women make up 48 percent of the U.S. workforce but just 24 percent of STEM workers (US Census Bureau).
- African Americans and Hispanics have been consistently underrepresented in STEM employment. In 2011, only 6 percent of the STEM workforce was African American, and 7 percent were Hispanic (US Census Bureau).
- Only 9 percent of employed scientists and engineers in 2015 were people with disabilities (National Science Foundation).

OUR COMMITMENT

FHI 360 is committed to growing the number of women and underserved communities working in STEM. Our commitment is guided by two core values: start early and be equity-based, providing a strong foundation for all. We have conducted early groundbreaking work in STEM and gender equity, taking an early childhood approach, and our *Playtime is Science* program was designated a Promising Gender Equity Program by the US Department of Education.

WHAT WE DO

FHI 360 works to level the playing field by developing equity-based curricula, grounded in research, for use in school, afterschool and other informal settings. Our curricula span pre-Kindergarten through elementary and middle school. All curricula stress family involvement, which has been shown to be an important factor in children's success. We have refined and tested these curricula and created easy-to-use implementation guides that allow them to be delivered on a large scale.

Afterschool programs are especially valuable in helping to close the opportunity gap that many children and youth from underserved and underrepresented communities face. Of the 8.4 million children in afterschool programs, girls and ethnic minority children are more likely than others to participate (Afterschool Alliance, 2011). Our informal science curricula are designed to enable young people to identify as STEM enthusiasts and future members of the STEM workforce, while avoiding the traps of stereotypes and misconceptions that have resulted in an unbalanced workforce. We provide training, coaching and technical assistance nationwide.

We are primarily advocates for equity in STEM education, producing research and position papers to help galvanize the movement toward early, equity-based learning. For example, a recent project, *Furthering Girls' Math Identity*, brought researchers and practitioners together to explore how we can build a positive math identity in young girls so that they will get excited about and succeed in STEM. We are continuing to work in this area, and are now studying girls' beliefs and dispositions toward math to explore the link between STEM identity and academic achievement.

PRODUCTS

Our curricula are designed to encourage interest in STEM and support for a positive STEM identity for children of all ages and backgrounds. They allow for experimentation, spontaneity, and family involvement, and use free or low-cost materials so that they are accessible to all. Examples include:

- *Playtime is Science* is an early childhood, Pre-Kindergarten-3, inquiry-based science program that encourages girls and children from other underrepresented groups to think of themselves as scientists and to develop the higher order thinking skills such as problem-solving, creative- thinking, and decision-making. The program is unique in its focus on strong family involvement, accessibility for students with a broad range of disabilities, and the physical sciences, an area often neglected at the early childhood and elementary levels.
- *After-School Math PLUS (ASM+)* provides opportunities for young people to increase skills and interest in everyday math through thematic units that use free or low-cost materials. Students work together on projects that enable them to hone their math skills while having fun with sports and games, architecture, art and music.
- *After-School Science PLUS (AS+)* is an inquiry-based activity program featuring fun activities that enable students to expand their views about who does science, and to see themselves as future scientists. Students get into the process of science by predicting, observing, experimenting, building, and inventing, using common household items.

With our curricula thoroughly grounded in research, we are always looking for new and innovative ways to approach equity-based education, as evidenced by our newest explorations into STEM identity.