BUSINESS PARTNERSHIPS TO ADVANCE STEM EDUCATION:

Building a Bridge to Careers in STEM

Focus on Girls

Report

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Program

Designed and Conducted by the Council for Educational Change

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The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation.

Business Partnerships of José Martí MAST 6-12 Academy

Educational Partners

Ben Sheppard Elementary: JM-MAST invites the Pre-MAST students to participate in lab experiments at the school on a regular basis in order to promote STEM in elementary.

Council for Educational Change: The CEC has assisted JM-MAST in obtaining partnerships, managing the grant, offering advice and promoting the school.

Committee for Economic Development: The CED provided JM-Mast with a generous grant for the Business Partnerships to Advance STEM Success (B-PASS).

Florida International University: Faculty of JM-MAST participated in professional development focusing on The Common Understanding of STEM and Instructional Strategies for all subject areas. Students participate in the FIU Annual Honors College Research Conference.

LARC Technology Institute: Established the website for the JM-MAST/B-PASS grant information and implementation. LARC has provided: students with hands on workshops; teachers with professional development on web design; free computer repair to faculty, staff, parents and students of JM-MAST.

Miami Dade College-North Campus: MDC has selected JM-MAST to participate in the FCCAgE/USDA Florida Caribbean Consortium for an Agriculture Education Grant which has enabled our students to build and maintain an herb garden. MDC offers many field trips to our students, they participate in presentations and lab experiments at the college. MDC has also provided professional development to faculty on STEM across the curriculum.

June 2013
Miami, Florida

Supportive Partners

Cleveland Clinic: JM-MAST students participated in the eXpressions™ award winning educational initiative that utilizes creative expression to engage high school students in the exploration of science and medicine.

Ford Motor Company: JM-MAST students participated in the Driving Skills for Life which is part of Ford's long-standing commitment to teen driver safety.

Junior Achievement of Miami: JM-MAST students participated in JA personal finance and recognized the fundamental elements for their personal finances: earnings, saving and investing, budgeting, credit risk management and giving.

Miami Science Museum: Students of JM-MAST participated in the National Youth Summit focusing on contemporary environmental issues and the legacy (as well as lessons learned) from the Dust Bowl. Students have also prototyped a new live surgery fieldtrip for the museum and participated in the Brain Fair.

NASCAR: Through hands on activities and driver integration, NASCAR and its educational partners showcased how STEM and teamwork come alive outside the classroom in sports and potential careers in a ten-week interactive program.

NOAA: JM-MAST students participated in engaging presentations by NOAA and used their data to practice gathering and analyzing.

¡Yo Soy Hialeah!: Through this community website, we post videos, articles and important events that take place at José Martí throughout the school year. This also assists us in marketing the school and recruiting more students.

Zoo Miami: Students of JM-MAST have the opportunity to participate in the Conservation Teen Scientist program (CTS). It offers high school students valuable volunteer opportunities, while fulfilling the Zoo Miami's mission of wildlife conservation and enhancing the visitor experience through eco-literacy interpretation. Zoo Miami also offers field trips and presentations.

Extracurricular Partners

ALM Sports: JM-MAST students have the opportunity to play sports afterschool with ALM Sports, as a Magnet School we cannot offer sports.

AmericaTévé: JM-MAST Spanish speaking students report on topics of interest and appear in the America Tévé "Los Reporteritos" segment of the local news.

Dream in Green: The students in the Green Club are participating in Dream in Green to create environmental educational programs that decrease greenhouse gas emission through a multi-pronged approach that promotes energy efficiency, conservation, and the use of renewable energy.

Fairchild: JM-MAST students have the opportunity to participate in a collection of challenges that offers an exciting mix of environmental educational opportunities. JM-MAST teachers have the opportunity to participate in Fairchild's professional development courses.

Rhythm and Pitch School of Performing Arts: Rhythm & Pitch is providing the students of JM-MAST the opportunity to participate in Dance and Musical Ensemble after school.

Women of Tomorrow: The Women of Tomorrow Mentor & Scholarship Program mission is to inspire, motivate and empower young women to live up to their full potential through a unique mentoring program with highly accomplished professional women, and scholarships.

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Contents

Business Partnership to Advance STEM Success (B-PASS)

Committee for Economic Development
www.CED.org

Council for Educational Change
www.ChangeEducation.org

José Martí MAST 6-12 Academy
www.mast3.com
www.mast3.larctech.com

Miami Dade County Public Schools
www.dadeschools.net

Introduction

Educational leaders and policy makers are focused on the critical issue of workforce competitiveness in STEM fields -- Science, Technology, Engineering and Math. Even during the past few years of high unemployment, thousands of job vacancies in these fields went unfilled because of a lack of workers with necessary education and skills.

Engaging women in STEM education and career fields is a key linkage to overcoming this skills gap. In August 2011, the U.S. Commerce Department released a study, *Women in STEM: A Gender Gap to Innovation*, which found that although women make up almost half of the U.S. workforce and half of the college-educated workforce, they are greatly underrepresented in STEM jobs and among those with STEM degrees. While the report found that contributing factors may likely include a lack of female role models and gender stereotyping, it ultimately found "evidence of a need to encourage and support women in STEM." Educators and administrators at schools like José Martí Math and Science Technology (MAST) 6-12 Academy in Hialeah, Florida, believe that the key to increasing the numbers of women in STEM careers begins with eliminating barriers for young girls who excel in STEM-related subjects.

In the 2012-13 academic year the school set out to address these barriers with help from state and national education and business organizations who have partnered with the school to develop a model program to increase STEM success for all students.

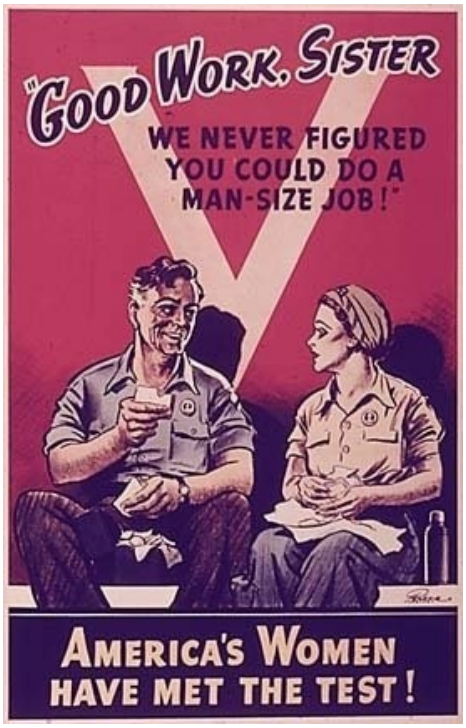
In cooperation with Miami-Dade County Public Schools, the Council for Educational Change -a Florida education think tank- developed B-PASS, which is the Business-Partnership to Advance STEM Success. B-PASS supports the development and implementation of a model school STEM program that will lead to improved student performance at José Martí MAST 6-12 Academy (JM-MAST). The pilot program, which developed partnerships between the school and local businesses, museums and professional organizations, was funded by the Committee for Economic Development (CED) with generous support from the Bill and Melinda Gates Foundation. CED is an independent, non-profit, non-partisan think tank based in Washington, D.C. Made up of nationally recognized business leaders, CED focuses on education policy and other public policy issues.

A History of Absence

According to *Generation Stem: What Girls Say About Science Technology Engineering and Math*, a report by the Girl Scout Research Institute, the history of absence among girls in STEM-related high school courses results at least in part from girls' perceptions of the subjects and careers and their own abilities. However, the primary finding of the report was good news.

"As opposed to the past stereotype, that even girls who perform well academically are not interested in STEM (because it is a "boy thing"), our research demonstrates that interest among girls is there, it just needs to be primed," according to the report which found that 74 percent of teen girls are interested in STEM. Interest was defined as responding "somewhat" or "very" interested in STEM subjects. Yet, barriers continue to exist.

The report found that more than half (57 percent) of all girls say that girls their age don't typically consider a career in STEM, while 47 percent say they would feel uncomfortable being the only girl in a group or class. Finally, 57 percent say that if they chose a STEM career, they would have to work harder than a man "to be taken seriously."



In these findings are the seeds of a national pattern reflected in the Commerce Department study:

- Women hold less than 25 percent of STEM jobs, despite filling half the jobs in the American economy. Even with an increase in college-educated women with degrees in STEM fields, this gender gap has continued over the past decade.
- This gap has added to the gender wage gap. Women with STEM jobs earned 33 percent more than women in non-STEM related jobs, considerably higher than the STEM premium for men.
- Women hold a disproportionately low share of undergraduate degrees in STEM fields, particularly in engineering.

The two sets of findings, one looking at the perceptions of girls and the other focused on the women in STEM careers, underscore the cause and effect. They also offer insight into both the scope of the problem, and the opportunity for schools like JM-MAST that are determined to begin reversing the trend.

The Challenge at JM-MAST

Originally established in 1987 as José Martí Middle School, JM-Mast was a traditional public school until May 2011. With the ability to recruit high-performing students and institute minimum standards for enrollment, José Martí was transformed from a "C"-rated middle school to an "A"-rated MAST school.

The task of converting a traditional middle school into a 6-12 math and science-focused institution with limited funds resulted in a long list of priorities for administrators. In addition to providing a learning opportunity worthy of the name, at the heart of the effort are recruitment and retention of students.

When the school opened in August, the freshman class of 9th graders began with 50 students (now 46), only 12 of whom were girls and now 10th graders. In the 2012-2013 9th grade class, recruitment jumped to 75 students and 25 girls. As administrators focused on creating a successful STEM program, they noticed a glaring reality: "Girls are underrepresented in STEM," said Ivette Diaz-Rubio, assistant principal at JM-MAST. "As we noticed in enrollment and in classes, it's predominantly boys, with a few girls sprinkled in -- especially when you get to the higher-level math. We want to ensure that if they want the opportunity, they know the opportunity is there for them. There's no reason for them not to (take the opportunity) just because they're girls."

With the B-PASS program in place by August 2012, Diaz-Rubio was able to use the business and education partnerships along with other strategies to focus on retention and mentoring for girls.

B-PASS Strategies for Success

Being a new school with a new program meant that the strategies employed at JM-MAST to engage and foster girls' interest in STEM would grow along with the school. JM-MAST's teachers and staff continuously identify challenges and needs, and work to develop and implement the strategies to address them.

One key area has been the recruitment and retention of girls. With such a small number of girls at the school, Diaz-Rubio, who heads recruitment and retention efforts, developed strategies with B-PASS partners to support the girls' efforts, address their negative perceptions of math and science, and target the root causes. B-PASS programs and events offered the girls consistent encouragement and learning experiences designed to address their perceptions of STEM, including:

- **Miami-Dade Community College** and **Women of Tomorrow** assisted JM-MAST in developing and presenting a panel of successful women in STEM-related professions, including a dynamic manager at Blackberry, who described their careers and experiences.
- **LARC Technical Institute** presented a girls-only workshop, in which girls took apart and reassembled a computer.
- **NASCAR** provided girls an opportunity to build and race go karts with the boys.
- **ZOO Miami** offers hands-on work experience to girls and boys.
- **Women of Tomorrow** provides a mentoring program and encourages girls to take initiative and leadership roles, to understand the value of networking and working together, and encourages them to dream big.

Specifically, these gender-specific workshops, meetings and events with faculty and STEM business partners are designed to:

- Build confidence in girls who excel in math, science and technology
- Establish role models
- Educate girls about the breadth of career choices open to them
- Expand girls' perceptions of their career choices
- Offer practical "real world" experience to girls interested in careers in STEM
- Develop an environment that empowers girls

The school has also used the current students as ambassadors to the school and program – deploying them in recruitment efforts to speak directly with potential students.

Professional development and all-girls classes

JM-MAST also learned quickly that teachers need to be supported along the way about the unique challenges of educating girls in the STEM fields. The new curriculum and STEM focus has required many teachers to shift or adjust their teaching strategies. JM-MAST has identified these professional development needs and provided opportunities for teachers to participate. These opportunities have included integration of gender-specific strategies for teaching and engaging girls.

JM-MAST also piloted the idea of all-girls classes, creating an all-girls algebra class. This was a successful exercise as teachers noticed the girls began to participate more, both within the all-girls class and in other co-ed classes.

Emerging Outcomes

Although the B-PASS program is less than one year old, emerging outcomes based on perceptions of students, administrators and B-PASS partners point to success in key areas.

Retention and Recruitment

- While JM-MAST lost a few girls, who either decided the coursework was too rigorous, wanted a more traditional high school experience or moved away, more than 90 percent of the girls stayed.
- JM-MAST saw a 30% increase in female applicants for ninth grade for the 2013-2014 school year.

Awards

- Among Miami-Dade Regional Science Fair winners this year was Yenny Dieguez, a ninth grader, who received a superior award. She was named a state finalist and was one of four high school students to represent Miami-Dade at the 2013 International Science & Engineering Fair where more than 70 countries are represented. Yenny was also awarded the Innovative Engineering Award from the National Society of Professional Engineers and the Discovery Award.
- The Southeastern Consortium of Minorities in Engineering (SECME) students of JM-MAST, which included girls, won 2nd place in the robotic hand competition of the Miami-Dade Regional Science Fair.

Girls Speak Out…

Sara Gravedeparalta, 15, a tenth grader at JM-MAST, always enjoyed science, and it showed in her excellent grades. Last year she received the highest grade in her science class. Despite her accomplishments and enjoyment of the subject, it was not until this year that she began to view science as more than just a fun pastime.

"I loved math and science, but I used to look at it as a hobby, not like my career. I didn't really know about it. No one had really talked to me about all the careers, all the opportunities."

This past year, Sara and other girls at JM-MAST were exposed to programs and strategies developed by JM-MAST with B-PASS partners, including an all-girl computer training workshop, a panel discussion of successful women in STEM fields and a job opportunity at ZOO Miami. The exposure changed her thinking.

While all of the strategies changed her perspective, she says, "The zoo was the main thing," because she received an opportunity to use what she learned in a real-world job. She explained: "As a volunteer at ZOO Miami, I educate visitors about wildlife preservation."

Perceptions

- According to research[1], the most significant measure of success in determining everything from grades to retention to future careers in STEM is the attitudes of girls toward STEM subjects. Based on responses of girls who participated in a focus group at the school, employing B-PASS and other efforts to engage and inspire the girls positively impacted both perceptions and retention. Girls tend to like JM-MAST because "*it's smaller, and the kids' attitudes are way better. They're focused.*" They also appreciate the acknowledgement of their successes.

> *"We don't get more attention than the guys. We all get attention, but …every time the girls accomplish something we're recognized as girls. A girl did this in science. It makes you feel powerful as a woman."*

- Girls at JM-MAST often come from homes that emphasize traditional gender roles, which can prevent them from considering STEM careers. The panel of successful women in STEM-related professions helped them realize they could combine having a family with a STEM career--a turning point for at least one girl who had planned to leave the school earlier in the year, but decided to stay after hearing the panel.

- Even the girls who excel in math and science often do not view STEM careers as viable options. That is changing, as one girl explained: "*I loved math and science, but I used to look at it as a hobby, not like my career. I didn't really know about it. No one had really talked to me about all the careers, all the opportunities.*"

Advancing the Program: Next Steps for JM-MAST

The initial work done by JM-MAST to recruit, retain and foster interest among girls in STEM has been done mostly as reaction to identified needs. With this experience, JM-MAST now has a good understanding of what steps need to be taken next to ensure the long-term success of the program and the students it serves. These next steps represent a formalizing of the practices and process that JM-MAST has developed over the past two years. Many of them are transferable to other schools interested in creating opportunities for advancing the success of girls in STEM education.

[1] Modi, K., Schoenberg, J., & Salmond, K. (2012). Generation STEM: What Girls Say about Science, Technology, Engineering, and Math. *Girl Scouts of the USA;* New York, N.Y.

1. Intentionally focus on supporting girls in STEM as an ongoing need in terms of strategies, programs and funding. One of the first and most significant discoveries JM school officials made was the need for more intensive and creative recruitment and retention efforts for girls. JM-MAST has found that the partnerships created with business and other organizations have helped advance female students' understanding and engagement in the STEM fields. Continued funding support of the program is critical to help ensure retention of girls at JM-MAST. As school work becomes more rigorous for girls in higher grades, continuing these strategies could help encourage them to stay the course. Likewise, as the girls move closer to graduation and college, the pressures of competition with male counterparts for internships and scholarships in these fields will only increase. Based on the research conducted by the Girl Scouts, as well as others[2], and the findings of this report, girls entering programs like JM-MAST in the lower grades will require interventions that reorder their thinking about what they can achieve and the options available to them.

Girls Speak Out…

Thalia Pacheco, 14, an eighth grader at JM-MAST, loves math and also has a passion for television journalism. She is a member of "Los Reporteritos," an extra-curricular club offered at the school through B-PASS partner, America Tévé, which offers Spanish-speaking students the opportunity to report on topics of interest and appear in its *Los Reportertitos* segment of the local news.

"I feel I have a passion for it," she says. Thalia currently reports on historical places around Miami-Dade County. A Los Reporteritos segment was nominated for an Emmy award this year.

Thalia even combined her love for math with reporting. She did a segment about how students will actually use advanced math subjects in the real world – even though they initially thought they would never use them again. She says she was "kind of shy" when she first began reporting. Today she can speak in front of anyone. "I feel I've grown more confident. I've learned a lot."

2. Expand offerings of all-girl classes in math and other STEM subjects. The success of the all-girls algebra pilot could be replicated in other subject areas to advance the confidence of girls in STEM. The pilot showed that girls will feel less intimidated, and therefore more comfortable participating in an all-girl class. In these classes, they can develop self-confidence and leadership skills necessary to compete not only as high school students, but in college and in their future careers. The girls are then stronger, more active participants in co-ed classes.

[2] McCulloch, Keene, &Kenney, (2013). *School Science and Mathematics, Vol. 113(4), pp. 201-210);* Drexler, P. (2013). *Wall Street Journal ;* Min, et. al, (2011). *Journal of Engineering Education, Vol. 100, pp.349-373);* Fantz, et. al, (2011). *Journal of Engineering Education, Vol. 100, pp.604-623);* Zeldin & Pajares. (2000). *American Educational Research Journal, Vol. 37, pp. 215-246.*; *Women in STEM: A Gender Gap to Innovation,* (2011).U.S. Department of Commerce, Economics and Statistics Administration, Washington, D.C.

3. Secure additional business partnerships and funding to establish internships in STEM careers for female juniors and seniors. While offering opportunities for all students, the internship program would support and encourage girls in STEM. JM-MAST began by facilitating internship opportunities through existing partnerships and by educating partners about the critical need for experience among female students eager to work, particularly in areas which do not traditionally attract women. Additionally, JM-MAST should ***strategically seek new partnerships based on female students' potential career interests. These internships would be invaluable in giving girls work experience and helping them compete.***

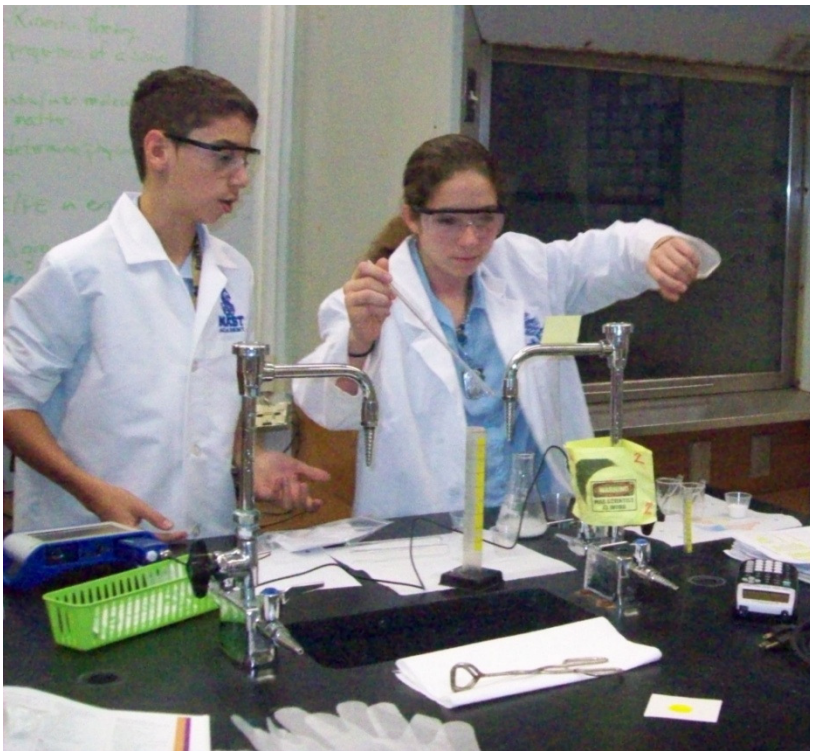
4. Provide professional development opportunities for school staff to learn additional strategies for retaining and encouraging girls in STEM. Programs would include information about what teaching methods promote participation by girls, and what methods decrease or halt participation. Professional development would help to ensure that school strategies regarding girls and STEM are understood and implemented across the board.

5. Expand the B-PASS website for use as a stronger marketing tool for parents, students and potential partners, and to educate the public about girls and women in STEM. The B-PASS website created this year by partner LARC Technical Institute can become an important "one- stop shop" for connecting with potential partners, students and opinion leaders in Miami-Dade County. The site should include pages that outline the purpose, benefit and success stories related to business partnerships. Each partner and their specific contributions would be featured on the site. In addition, the site should include information about girls and women in STEM: the latest studies, news articles, links to government agencies and other sources focused on the topic, and information about local women in STEM. Students should be asked to write articles on local women in STEM, and their own experiences, as part of their class work.

6. Develop "curriculum" to welcome and educate B-PASS partners and new recruits about the program. The partnerships with business have been invaluable to JM-MAST and the students participating. However, JM-MAST found that they were spending a lot of time orienting partners throughout the year, which provided for inconsistent information and was time

consuming. Further, in interviews with partners it was learned that there was a disconnect in understanding the school's goals and objectives for the program. There was no intentional recognition of how the programs were directly benefitting girls' success. JM-MAST learned that there needed to be a more formalized structure and strategic recruitment of partners to ensure integration of partnership goals and objectives with the mission and vision of JM-MAST. The yearly orientation would include the background of the program and specific examples of successes by current partners. The presentation would include current needs, and facilitate a board-like atmosphere to generate specific ongoing contributions of funding or other resources and/or one-time needs for a given year. To assist businesses in understanding the goals of the program, focus them on STEM issues for JM-MAST and the nation in general and girls in particular as they plan programs and strategies.

7. Recruit more "Women in STEM" speakers to motivate girls and educate all students about women in STEM. Girls at JM-MAST overwhelmingly speak about the positive impact of speakers and workshops on their perceptions of STEM subjects and what they could achieve. The experience of meeting women in a STEM career, rather than reading about someone in a book, created an atmosphere of excitement for the students and made the possibility of a career in STEM seem achievable.



8. Develop a cross-peer mentoring program to provide support for younger girls in STEM and leadership opportunities for older girls. Cross-peer mentoring would be an invaluable tool to help girls who may lack confidence or have negative perceptions about STEM. The process would allow older girls to experience being "looked up to" by their younger peers, increasing their confidence and leadership skills. The process would also provide an additional retention strategy.

Visit the JM-MAST/B-PASS website at www.mast3.larctech.com to get a more in-depth look at the Business Partnership to Advance STEM Success initiative and to learn how it can change a school.