



## PLP Innovation and Technology Opportunity Grant Program

### 1. One paragraph project summary.

The **Make-HER** program will provide school-aged girls and their mothers (or other female adult mentors) the opportunity to collaborate in carrying out project-based, hands-on STEM learning. Four interactive workshops using Makey Makey and Arduino will be led by female professionals in the science and engineering fields. An additional four hands-on workshops will be led by female technology educators who focus on the process of ProtoStorming. ProtoStorming integrates brainstorming with prototyping to initiate a workable solution to a problem. Girls and their mothers will use readily available materials to uncover the creative thought processes that lead to technology innovation. In the out-of-school, non-evaluative environment of the Library, mother-daughter teams will be able to experiment with science and technology, taking on new roles that may not be realized in more formal instructional settings. The teams will be able to apply their creativity to the use of existing tools as well as the creation of new tools. Girls will gain the benefit of working with adult role models in STEM fields and mothers will gain skills and understanding to support girls in their possible pursuit of science and technology careers. Librarians have already received training from the Resource Area for Teaching (RAFT) and the San Jose Museum of Technology and Innovation in the use of Tech Challenge kits, and will use these kits to provide additional after-school STEM-related programming for girls. Families will be encouraged to use the Library's **Discover and Go** program for free or discounted admission to the San Jose Tech Museum, Lawrence Hall of Science, Exploratorium, and Children's Discovery Museum. By incorporating the active participation of mothers and opportunities for further STEM exploration, **Make-HER** fosters a tech identity in girls that can extend beyond the library into home and school.

### 2. Explain how this project fits with the library's strategic directions.

***The mission of the Sunnyvale Public Library is to be a gateway to lifelong learning and enrichment in a safe, nurturing and dynamic environment for the residents of Sunnyvale.***

The Sunnyvale Library has long been committed to helping patrons learn to use new technologies to support their information needs, educational goals, and personal enrichment. First in the Bay Area to purchase a 3D printer and offer patrons the ability to transform ideas into tangible objects, the Library has embraced the maker movement through 3D Sketchup design classes, letterpress programs, LEGO design challenges, Adults Create programs, and Raspberry Pi coded community art.

Sunnyvale Library's commitment to supporting education and technology is particularly relevant for young girls. While young boys and girls show similar levels of interest and ability in science, research shows that girls have lower levels of confidence in their ability to do science (National Science Foundation, 2013). Educational equity for

women has improved over the last several decades, yet women still lag far behind men in pursuing higher education in science and engineering fields. In fact, young women's enrollment in computer programming majors has declined over the last two decades, possibly due to what has been termed a "bro-grammer" culture. Recent U.S. Department of Commerce data reveal that only 20% of bachelor's degrees in engineering, computer science, and physics are awarded to women, and women comprise only 24% of the workforce in STEM fields. Salaries for women in STEM fields are on average 33% higher than in non-STEM fields, and STEM jobs are growing at 1.7 times the rate of non-STEM jobs. Yet women remain an untapped resource in these high-growth, financially lucrative fields (National Science Foundation, 2008; U.S. Department of Commerce, 2011).

The National Science Foundation recently published a report on the features of effective STEM programs for girls. The report promoted the benefits of hands-on, project-based STEM learning environments for girls. Informal learning environments, such as museums and science centers, provide the opportunity for girls to collaborate with others who share their interests – without the pressure of school and grades. Role models are important as well. Girls build confidence in their ability to pursue similar educational and career goals when given the chance to work with female professionals in STEM fields (National Science Foundation, 2013). Parental attitudes also impact girls' achievement in math and science, and can affect career choices. When parents actively support their daughters' interest in science and math, they help build their daughters' self-confidence and broaden their career options (AWE: Assessing Women in Engineering, 2005).

As a vital part of the Sunnyvale Community, the Library is in a position to help level the STEM playing field for girls. The Library serves 2500 patrons on an average day, and on Saturday that number can approach 4000. Seven weekly story times draw over 450 attendees, and special program attendance can exceed 200. The visibility and reach of the Library allows it to be a force for positive change.

Consistent with the Library's mission to "be a gateway to lifelong learning and enrichment in a safe, nurturing and dynamic environment," the **Make-HER** program offers girls the opportunity to explore science, engineering, and technology in a low-pressure, fun environment and learn from female professionals who can serve as role models. Mothers who have STEM experience will have the chance to mentor their daughters in the programs. Mothers without such a background will gain knowledge in STEM concepts and will be better able to support their daughters' interest in these fields. With their female adult mentors' participation and support, girls' interest in STEM exploration and learning can extend beyond the **Make-HER** sessions and take root in the home as well.

3. A description of the proposed project including the population served and the demographics of that population.

Located in the heart of Silicon Valley, Sunnyvale has a population of nearly 150,000. Many residents were not born in the United States; over half speak a language other

than English in the home. Not only is the community culturally diverse, it is also youthful and family-oriented. The average age of residents is thirty-six, and families with children under age 18 make up a third of all households (U.S. Census, 2010). At the reference desk, we see many stay-at-home mothers whose husbands have taken technology jobs on temporary work visas. The evidence is anecdotal, but we see few fathers who are at home with the children while mothers work in the tech field.

The **Make-HER** program is all about women, young and old. It is designed to teach girls to apply their creativity both to the use of existing tools and the invention of new ones. Led by female professionals in the science, technology, and engineering fields, school-aged girls and their mothers (or adult female mentors) will have the opportunity to collaborate in carrying out project-based, hands-on STEM learning. Instructors associated with the San Jose Museum of Technology and Innovation will offer four two hour workshops using Makey Makey and Arduino microprocessor kits. Possible activities include conductive paint based musical artwork, interactive journals with Scratch programming, and hand-soldered, programmed LED jewelry. These instructors have led STEM camps and museum sessions, and are well-versed in activities designed to appeal to young women.

Girls and their mothers also will have the opportunity to attend ProtoStorming sessions led by female educators with backgrounds in engineering, science, or technology. ProtoStorming is a rapid brainstorming and prototyping process in which teams use recycled and/or readily available objects to explore the thought processes that lead to invention of new tools. Girls will learn to consider the attributes of various materials and determine how they can be combined to make objects that serve a purpose. For these sessions we are exploring a partnership with Learningtech.org, with whom we partnered for our recent Raspberry Pi Coding Camp. Learningtech.org is a California nonprofit organization that provides educational technology consulting and hands-on learning opportunities. We also are exploring partnerships with Chicktech.org and Techbridgegirls.org. These local nonprofit organizations encourage girls to pursue STEM-related careers by facilitating hands-on learning programs in science, technology and engineering.

To broaden the impact of the **Make-HER** program, librarians have been trained by RAFT and the San Jose Museum of Technology and Innovation in the use of their Tech Challenge Kits. These inexpensive kits contain activities designed for repeated use and larger groups. Librarians will offer regular, drop-in, after-school **Make-HER** programs to girls and women of all ages.

For further exploration, patrons will be encouraged to take advantage of the Library's **Discover and Go** program for free or discounted admission to the San Jose Tech Museum, Lawrence Hall of Science, and Children's Discovery Museum. Using **Make-HER** as a new way to promote the **Discover and Go** program, the Library will highlight the many local venues that offer STEM exploration.

#### 4. The goals and objectives of the project.

The goal of the **Make-HER** program is to engage and support girls in STEM learning, build self-esteem and confidence in their abilities to pursue STEM-related careers, and foster an environment of collaboration and exploration. The program is designed to foster in young women a sense that they are STEM girls, with a full access to STEM-related education and careers. In support of this goal, the **Make-HER** program includes the following objectives:

- A female Makey Makey educator associated with the San Jose Museum of Technology and Innovation will offer two hands-on Makey Makey sessions. Makey Makey is a kit that uses a printed circuit board and alligator clips to turn everyday objects (e.g., paper, play dough, fruit) into computer touchpads, keyboards, or mice.
- A female Arduino educator associated with the San Jose Museum of Technology and Innovation will offer two hands-on Arduino sessions. Arduino is an accessible, single board microcontroller that can be used to create interactive objects using sensors and actuators.
- Educators with engineering, science, and/or technology backgrounds will lead four sessions in ProtoStorming, problem-solving, and invention. ProtoStorming is a brainstorming approach used to identify attributes of various objects (e.g., floats, holds water, bends, expands, etc.) and then determine how objects can be used together to create items that serve a purpose or solve a problem.
- Sunnyvale Librarians who have already attended Tech Challenge Kit training will train their colleagues to offer after-school drop in sessions using low-cost STEM exploration kits. Activities may include roller coaster math, simple telescopes, solar collectors, and strawberry DNA.
- Sunnyvale Public Library will market its existing Discover & Go program to attendees at each **Make-HER** program. Discover & Go offers free or discount admission to local cultural institutions, including the San Jose Tech Museum, Lawrence Hall of Science, Exploratorium, and Children's Discovery Museum.

5. The project timeline (activities).

Activity	2015											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Collaborate with San Jose Tech Museum educators to schedule Makey Makey and Arduino workshops and refine activities	x	x										
Create a marketing plan for <b>Make-HER</b>	x	x										
Collaborate with Learningtech.org or Chicktech.org or Techbridgegirls.org to schedule ProtoStorming workshops and refine content	x	x										
Create surveys for workshop attendees	x	x										
Purchase Makey Makey kits, Arduino boards, and necessary supplies	x	x	x									
Promote <b>Make-HER</b> through Library website, email lists, and social media	x	x	x	x	x			x	x	x	x	x
Promote <b>Make-HER</b> through Sunnyvale School District librarians and Head of Curriculum	x	x	x	x	x			x	x	x	x	x
<b>Eight Make-HER workshops</b>			x	x	x	x						
Train Librarians in use of RAFT maker kits for after-school programs						x	x	x				
After-school drop in <b>Make-HER</b> programs									x	x	x	x
Complete and analyze surveys			x	x	x				x	x	x	x
Ongoing marketing for Discover & Go program			x	x	x	x	x	x	x	x	x	x

6. The evaluation of the project.

The primary instrument to measure success will be surveys given at the end of each **Make-HER** workshop. Girls will assess their change in understanding of the topic covered, their enjoyment of the workshop, their confidence in learning new STEM-related content, and their desire to explore the topic further in school or at home, and to what degree the workshop might influence their future educational or career choices. Adults will assess their change in understanding of the topic covered, their enjoyment of the workshop, their desire to explore the topic further with their children, and to what degree the workshop impacted their ability to support their daughters in STEM learning.

7. The project budget.

20 Makey Makey kits, including Makey Makey board, 6 normal wires, 6 colored alligator clip wires, and USB connector	\$1,000 + tax
20 Arduino starter kits, including Arduino Uno Rev3 Board, holder, jumper wires, breadboard, USB Cable, LEDs, DC motor, small servo, and relay	\$1,200 + tax
40 Arduino accessory kits, including resistors, buzzers, tilt switches, push buttons	\$600 + tax
200 RAFT Activity Kits for Librarian-led afterschool <b>Make-HER</b> drop-in programs	\$3,000 + tax
Additional peripherals, such as LED lights, conductive paint, copper tape, extra alligator clips with leads, tape, cardboard, sewing needles, wire cutters	\$500 + tax
Stipend for Arduino and Makey Makey educators, affiliated with the San Jose Museum of Technology and Education to teach workshops	\$2,000
ProtoStorming sessions, including materials and educator fees	\$4,000
Total	<b>\$12,300</b>