You may remember a night in your childhood looking at the stars on a clear night or your first view looking through a telescope. Can you recall that initial experience that sparked your passion for astronomy?

Imagine if, when you were full of the joy of this newfound wonder, you were actively and/or passively discouraged from pursuing it. This experience has happened to many girls and women, from staff here at the ASP to politicians and leaders such as Hillary Clinton. It’s time to change our approach so that female astronomers, present and future, are met with the openness and welcoming that is common for their male counterparts.

Many astronomers and astronomy educators are aware of this problem and are deeply saddened by it. They wonder what they can do to increase opportunities for girls and change this situation. I want to share with you some of the research I have uncovered in this area, and the work I’m involved with, so read on!

The Astronomical Society of the Pacific (ASP) is working to even the playing field. NASA’s Science Mission Directorate selected “-reaching for the Stars: NASA Science for Girl Scouts” as a new, 5-year space science education program that will bring together Girl Scouts with scientists, engineers and educators at NASA and beyond. Led by the SETI Institute’s Edna DeVore and Pamela Harman, partners include NASA STEM professionals, the Girl Scouts of Northern California, the Girl Scouts of the United States of America (GSUSA), the ASP, the University of Arizona, and Aries Scientific at Goddard Space Flight Center.
One focus of ASP’s work is to help create content for new space science badges for all stages of Girl Scouts, from the youngest “Daisies” (kindergarteners and first graders) up to high school, at the Senior and Ambassador levels. We are also assisting with an online resource guide for the adults who work with Girl Scouts — the Volunteer Tool Kit. Furthermore, we are doing workshops with astronomers to prepare them for working with Girl Scouts.

Creating these workshops has given me a wonderful opportunity to investigate the problem of how astronomy can be more welcoming to girls. Let’s explore some of those results now.

There has been a lot of research done in the last twenty years about making STEM more inclusive. The focus has been on how different learners engage with science, especially astronomy.

One key idea that has emerged in education and psychology is something called “growth mindset.” Based on work by Carol Dweck, who defined both fixed and growth mindsets in a 2012 interview:

“In a fixed mindset students believe their basic abilities, their intelligence, their talents, are just fixed traits. They have a certain amount and that’s that, and then their goal becomes to look smart all the time and never look dumb. In a growth mindset students understand that their talents and abilities can be developed through effort, good teaching and persistence. They don’t necessarily think everyone’s the same or anyone can be Einstein, but they believe everyone can get smarter if they work at it.”

With a fixed mindset, we accept much of the status quo and do not challenge it. When an authority figure tells us that girls aren’t good in math, or don’t belong in science, be that figure a teacher or parent (or from messages from society in general), it can become part of the mindset of our budding astronomer. If intelligence or mathematic/scientific abilities are supposedly pre-determined traits that belong to boys, then there is no path for girls to success. Of course, we know girls and boys have equal capabilities for scientific

Having a growth mindset encourages anyone willing to work hard and learn from mistakes to explore astronomy. [Nigel Holmes]
reasoning, and test results show us this, but myths are persistent. Growth mindset, however, is related to the way science is done. We live by trial and error. We make mistakes, we fail, and we try other strategies. We see how learning happens through practice and effort, and is not a set quantity determined at birth. With a growth mindset, a girl has ammunition to fight that authority figure and say, “Yes, I can. I may not have mastered this yet, but I can.”

So our first step to creating a welcoming environment is to have a growth mindset ourselves. For every astronomer reaching out to children, you must believe that each one of them can achieve their goals with effort, persistence and the ability to try different strategies when they get stuck.

Another group deeply involved in creating opportunities for girls is, of course, the Girl Scouts. The Girl Scout Research Institute released a study titled “Generation STEM” where they had nearly 1,000 girls answer questions about their interests in STEM. Their report also had tips for adults working with girls, but it ends with the quote:

“Girls should embrace their knowledge and abilities rather than be influenced by what society says girls should and shouldn’t be. And it’s important that adults remind girls what they’re capable of — and that their roles in life are limitless!”

The Girl Scouts also have three processes for encouraging girls. The programs should be “Girl-Led,” involve “Learn by Doing,” and utilize “Cooperative Learning.” Sometimes it can be tricky to re-imagine activities using these three processes. Let’s take an example of a traditional star party.

Often, amateur astronomers will set up telescopes, show the sky and sometimes give presentations on the objects to see in the

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The “Generation STEM” report showed that “Seventy-four percent of high school girls across the country are interested in the fields and subjects of STEM.” [Jean Fahy]
A Last Thought

While we won’t be able to reverse all of the sexism built up over our society’s history, we can give all children the tools to fight its effects. We can help girls to thrive, by creating interactions where they can practice their reasoning skills, build their science confidence, and contribute to scientific endeavors.

Set up a table of astronomy activities girls can do independently. [Girl Scouts of Northern California]

The basics still apply — dress warmly! [Girl Scouts of Northern California]
About the Author
Theresa Summer loves being an Astronomy Educator for the ASP. She has worked in science education since 1998, mainly in planetariums and museums, but also in high school classrooms, teacher trainings and tutoring. She has two Bachelor’s degrees: one in Astronomy and Physics from San Francisco State University; and one in Theater, Education and Empowerment from Eugene Lang College, the New School for Social Research. Her secret mission in life is to help people to understand that science is not just for crazed geniuses in lab coats, but is for everyone, and is an important part of being an active citizen in today’s world.

Resources
- SciGirls, a show from PBS and resource center: http://tpt.vo.llnwd.net/o26/scigirls/ScigirlsSeven_Print.pdf
- The National Girls Collaborative Project: http://ngcpproject.org
- A basic introduction to feminism and discrimination: https://everydayfeminism.com/tag/fem101/