



# ***SciGirls Reflect:***

## Leveraging Multiple Communities and Networks to Expand Understanding of Professional Development for Informal STEM Educators in Gender Equitable Teaching Strategies

### **Final Report**

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Developed by Brenda Britsch,  
National Girls Collaborative Project



## Executive Summary

*SciGirls Reflect: Leveraging Multiple Communities and Networks to Expand Understanding of Professional Development for Informal STEM Educators in Gender Equitable Teaching*

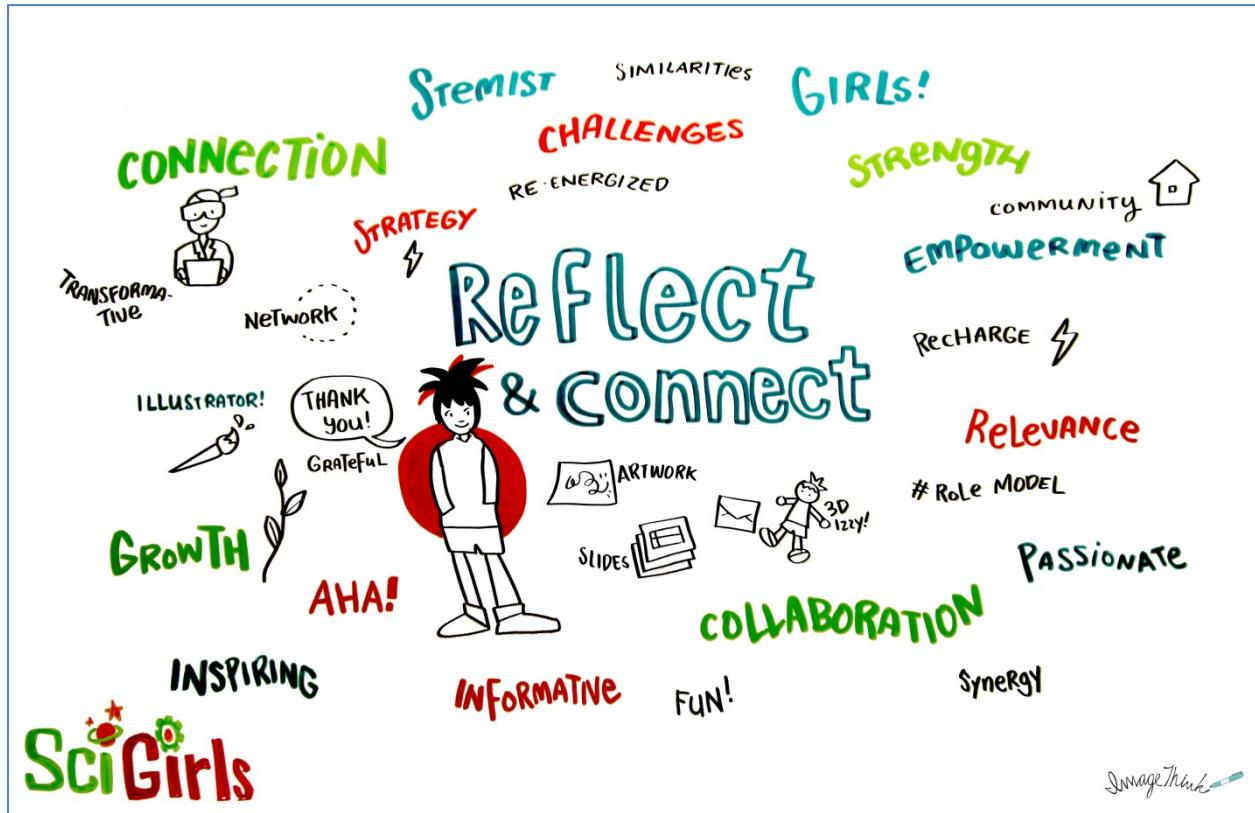
Strategies was a one-day event that brought together 25 *SciGirls* Trainers, Educators, and Partner Organization representatives to reflect on their experiences with *SciGirls*. Data was collected throughout the day via panel presentations, small group discussions, and partner interviews. Nineteen of these participants also conducted follow-up *Broadening the Discussion* interviews with *SciGirls* Trainers and Educators to gather additional data.

*SciGirls Reflect* produced a variety of rich data that demonstrates the impact of *SciGirls*, identifies challenges, and provides ideas for moving forward. Participants of the in-person event also benefitted from the opportunity to personally reflect on their experiences with *SciGirls* and to learn from a colleague about their experiences. *SciGirls Reflect* participants, both those who attended the *SciGirls Reflect* in-person event and those who participated in *Broadening the Discussion* interviews, provided valuable information about the impact *SciGirls* has had on them, their teaching, and their students.

Key findings include:

- **The value of the *SciGirls* resources, including the *SciGirls Seven* strategies, curriculum, and videos, cannot be overstated.** The quality of the resources and how they are packaged help educators provide engaging STEM activities and programs. Educators especially appreciate that the *SciGirls* strategies and resources are research-based. This gives them confidence that they will be effective and helps to make the case to incorporate them into their work.
- **Educators incorporate the *SciGirls Seven* strategies consistently into their work, especially Strategy #7 (role models), Strategy #2 (personally relevant and meaningful), and Strategy #3 (hands-on, open-ended projects and investigations).** Interestingly, some of the strategies that educators use extensively and believe positively impact their students are also ones that can be challenging to implement. These strategies, which have evidence to support them, are not necessarily easy to implement and educators' experiences point to the importance of implementing them well.
- **Educators firmly believe that the students they serve, girls in particular, are significantly impacted by participating in programs and opportunities that incorporate the *SciGirls Seven* strategies and *SciGirls* resources.** Educators cite powerful outcomes for their students, including increased confidence and interest in STEM and increased awareness of STEM careers and possibilities for their future.
- **Students are sometimes challenged by opportunities to collaborate, think critically, and chart their own path.** Similar to educators' experiences, strategies that can be beneficial for students can also be challenging, especially if they are not a consistent part of students' educational experience.
- **Role models are important.** Incorporating role models into programs (Strategy #1) was mentioned more than any other strategy as being valuable and impactful (as well as sometimes challenging). In addition to role models having a positive impact on girls, educators may find this strategy more significant because they have less experience with it or it is easier to distinguish from the other strategies and corresponding outcomes.

Despite minor challenges, *SciGirls Reflect* participants were overwhelmingly positive about the *SciGirls* resources and strategies and have a wealth of experience incorporating *SciGirls* in their programs and organizations. It is clear that, in addition to specific outcomes for educators and students, *SciGirls* has the potential to impact teaching practice and the bigger picture of STEM education.



# Introduction

## Event overview

*SciGirls Reflect: Leveraging Multiple Communities and Networks to Expand Understanding of Professional Development for Informal STEM Educators in Gender Equitable Teaching Strategies* was a one-day event that took place on December 2<sup>nd</sup>, 2015 in Seattle, WA. *SciGirls Reflect* was funded by a supplement from the National Science Foundation related to the *SciGirls CONNECT* grant and was organized by the *SciGirls CONNECT* team (Principal Investigator Rita Karl, Co-Principal Investigators Karen Peterson and Alicia Santiago, and *SciGirls* staff from Twin Cities Public Television.) *SciGirls Reflect* was held the day prior to the National Girls Collaborative Project (NGCP) Collaboration Institute to make it more feasible for participants to attend both events if they chose to. The NGCP Collaboration Institute is a national event that brings together professionals invested in increasing gender equity in science, technology, engineering, and mathematics (STEM) who are engaged in NGCP. Many *SciGirls* educators and trainers are involved in NGCP and participated in both events.

The objectives of *SciGirls Reflect* were:

1. To convene 30 *SciGirls* educators and trainers for a one-day meeting to discuss and document the challenges and successes of providing GETS (Gender Equitable Teaching Strategies)-based professional development for informal STEM educators;
2. To include panel discussions and small-group breakout sessions on professional development for informal STEM educators who train adults or lead girl-serving programs;
3. To gather evaluative data for use by TPT (Twin Cities Public Television) and NGCP in future program research and development; and
4. To identify and generate research questions that could ultimately extend this effort, helping us more deeply understand the impact of this ten-year GETS professional development program.

Twenty-five participants attended *SciGirls Reflect* including Certified *SciGirls* Trainers (84%), *SciGirls* Educators (68%), and professionals representing Partner Organizations (52%). Seventeen participants fit into more than one of these categories. Participants were most likely to represent an informal education organization, either a community-based organization (44%) or museum/science center (36%). Including *SciGirls* staff and facilitators, a total of 33 attendees were present throughout the day. (Note: Although the original goal was to have 30 *SciGirls* educators and trainers participate in *SciGirls Reflect*, the limited amount of time between receiving the supplement and hosting the in-person event resulted in 25 *SciGirls* educators and trainers being able to participate.)

In order to participate in *SciGirls Reflect*, current *SciGirls* educators, trainers, and partners were required to submit an application to the *SciGirls CONNECT* team. The *SciGirls CONNECT* team selected participants and hosted an informational webinar for participants to provide information about the event, solicit their feedback about the agenda, and to answer any questions they had.

*SciGirls Reflect* participants spent a full day together engaging in various activities designed to solicit their feedback related to their experience with *SciGirls* training and resources, focused in particular on impact on educators and youth. The day included two panel presentations, two small group discussions, and two activities. Creator of *SciGirls*, Dr. Richard Hudson, kicked off the day with a brief history of *SciGirls* and Dr. Roxanne Hughes presented on evaluation during lunch. (See Appendix A for the *SciGirls Reflect* agenda.) Participants gathered in the evening at

the Museum of Flight to explore the museum, share dinner, and hear from Dr. Dale McCreedy and Dr. Lynn Dierking, co-authors of *Cascading Influences: Long-Term Impacts of Informal STEM Experiences for Girls*.

### **Action Research Project overview: *Broadening the Discussion***

*SciGirls Reflect* participants were encouraged to conduct an Action Research Project following the *SciGirls Reflect* in-person event. This project involved interviewing a *SciGirls* educator in each participant's local community, someone who did not attend the in-person event. The project, titled *Broadening the Discussion*, was designed to gather information about the experience of additional *SciGirls* educators to add the base of knowledge for this report and for *SciGirls* overall. The hope was that *SciGirls Reflect* participants would also benefit from the experience of interviewing another *SciGirls* educator about their experiences. (See Appendix B for the Broadening Discussion project directions and questions.)

Eighteen participants interviewed a total of 22 *SciGirls* educators as part of the *Broadening the Discussion* project. The group of educators who were interviewed included certified *SciGirls* Trainers (41%), ranging in experience from less than 1 year to 6 years, and *SciGirls* Educators who run *SciGirls* programs for youth (72%), with 1-5 years of experience. Similar to the *SciGirls Reflect* participants, the educators who were interviewed were most likely to represent an informal education organization (museum/science center or community-based organization), but included a greater percentage of K-12 teachers/staff (38%) than the *SciGirls Reflect* attendees.

Educators who were interviewed were most likely to discuss implementing *SciGirls* as part of a summer camp/program or afterschool program, with just a few examples taking place during the school day or one-day events. About half of the educators reported they worked with all girls and about the same number reported they worked with a diverse population, but not all educators provided demographic information about the youth they served.

## **SciGirls Reflect in-person event findings**

### **The SciGirls Seven: Proven Strategies for Engaging Girls in STEM**

During a small group activity at the event, *SciGirls Reflect* participants were grouped based on what type of organization/sector they represented: Science Center/Museums; Community-Based Organizations; Higher Education/Universities; Hispanic-serving Organizations; and other Informal Education. Each group worked together to determine 2-3 *SciGirls Seven* strategies that they find most valuable, use the most in their organizations or with their audience, and what benefits and challenges they have experienced with each strategy.

For reference, the *SciGirls Seven* strategies are listed below. For more information on the *SciGirls Seven* strategies, please visit <http://scigirlsconnect.org/page/scigirls-seven>.

1. Girls benefit from collaboration, especially when they can participate and communicate fairly.
2. Girls are motivated by projects they find personally relevant and meaningful.
3. Girls enjoy hands-on, open-ended projects and investigations.
4. Girls are motivated when they can approach projects in their own way, applying their creativity, unique talents, and preferred learning styles.
5. Girls' confidence and performance improves in response to specific, positive feedback on things they can control – such as effort, strategies, and behaviors.
6. Girls gain confidence and trust in their own reasoning when encouraged to think critically.
7. Girls benefit from relationships with role models and mentors.

*"The SciGirls Seven strategies are the perfect formula for creating and building confidence in a safe environment."*

*-SciGirls Reflect participant*

Educators representing different types of organizations cited many of the same strategies and discussed benefits and challenges of each. The most cited strategies were Strategy #7: *Girls benefit from relationships with role models and mentors*, Strategy #2: *Girls are motivated by projects they find personally relevant and meaningful*, and Strategy #3: *Girls enjoy hands-on, open-ended projects and investigations*.

#### **Role models and mentors**

*SciGirls Strategy #7: Girls benefit from relationships with role models and mentors* was listed by each of the five groups as one of the most valuable strategies. Challenges related to this strategy were similar across groups, focused on making sure role models and mentors are 'equipped' to be effective, that they have adequate training (especially related to communication), and have the necessary time available. Additional challenges include recruiting diverse role models (Community-based organizations), perceived class differences and having a limited pool of potential role models and mentors to ask (Hispanic-serving organizations), and finding the right fit (other Informal Education).

Community-based organizations and other Informal Education noted the link between using role models and making content personally relevant for youth (Strategy #2). Science Centers, Community-based organizations, and Universities benefit from their unique access to role models (staff, college students, teen mentors), and Community-based organizations find that

role models provide a way to connect with companies that may be looking for ways to engage with the community. Hispanic-serving organizations cited benefits for girls in seeing someone like them and opening up career options and organizational benefits of having role model champions, creating family buy-in, and potential funding opportunities via role models.

### **Personally relevant and meaningful**

Four of the five groups listed *SciGirls* Strategy #2: *Girls are motivated by projects they find personally relevant and meaningful* as one of the most valuable strategies. Universities use this strategy when training college students and Hispanic-serving organizations find it creates buy-in for girls (they care) and provides an opportunity for educators to connect with students at a deeper level. The most common challenge mentioned related to this strategy was knowing and understanding what is relevant, especially when working with diverse populations. Universities are also concerned that the person leading the activity ‘gets it’, and Science Centers are concerned about the cost for parents and schools.

### **Hands-on, open-ended projects and investigations**

Three groups listed Strategy #3: *Girls enjoy hands-on, open-ended projects and investigations* as one of the most valuable strategies. For Science Centers, providing these types of activities is what they already do and they find it leads to Strategy #6: *Girls gain confidence and trust in their own reasoning when encouraged to think critically* in their environment. Community-based organizations find this strategy is the key to attracting youth participants and that turnkey activities are easy to replicate and scale. Science Centers are challenged by cost (both for access and materials), Universities are challenged by discipline and ties to standards and evaluation, and both of these groups find time a challenge when implementing this strategy.

### **Collaboration and creativity**

Community-based organizations and Universities also listed Strategy #1: *Girls benefit from collaboration, especially when they can participate and communicate fairly*, as a valuable strategy for their organizations, citing benefits for Community-based organizations to provide events (space, in kind support, materials, money) and fighting the urge to focus on competition (which is also a challenge) for Universities. University representatives also listed Strategy #4: *Girls are motivated when they can approach projects in their own way, applying their creativity, unique talents, and preferred learning styles* as valuable for them, although time and curriculum design can make this challenging to implement.

### **Alignment with NGCP findings**

These findings align with previous evaluation results related to strategies used by educators in the NGCP community. In 2014, 46 NGCP mini-grant recipients reported using multiple exemplary practices in their projects (exemplary practices include, but are not limited to, the *SciGirls Seven* strategies). Most commonly, mini-grant recipients reported using the same three *SciGirls Seven* strategies that the *SciGirls Reflect* educators were most likely to report using: making activities or content relevant and meaningful to participants (89% of projects); using hands-on, open-ended projects (84%); and providing opportunities to connect with role models or mentors (84%) (Liston & Coulon, 2015).

## **Project Examples**

During the *SciGirls Reflect* event, participants interviewed (and were interviewed by) a partner about a successful project, lesson plan, or activity she/he has implemented with students using the *SciGirls Seven* strategies and/or resources.

The overwhelming majority of participants served all girls in their project examples, ranging in age from kindergarten to high school. Many participants reported serving a very diverse population in terms of race/ethnicity and/or socio-economic status. Most project examples occurred in afterschool or summer programs, with the exception of just a few that took place during the school day or were one-day events.

Specific *SciGirls* activities described included Parachute Parade, Wetland Band, Dough Creatures, Puff Mobile and Blowing in the Wind. In addition to specific activities, participants also used some consistent language when describing what they did, drawing on terms used in the *SciGirls Seven*, such as ‘collaboration’, ‘personally relevant’, and ‘hands-on’.

Almost half of participants report using all seven of the *SciGirls Seven* strategies in their project examples. Using role models and having hands-on, open-ended projects are the two specific strategies participants mention most, in addition to those who report using all of the strategies. This finding is similar to those reported previously. In the *Evaluation of SciGirls Season Two Outreach Program* report, educators were also most likely to report their students engaged in collaborative activities and hands-on, open-ended projects and investigations (Knight Williams, Inc., 2014). Many participants report using the *SciGirls* curriculum and activity guides and a few mention using the *SciGirls* videos, but there is also a strong focus on integrating the strategies themselves. An overwhelming majority of participants discuss incorporating the *SciGirls Seven* strategies into their work in general and into already existing programs and curricula which is in an indication of how extensively *SciGirls Seven* are being utilized in practice.

### Youth response

*SciGirls Reflect* participants asked their partners how their students responded to the project example, including what worked and what did not work in each situation. Overall, students were very engaged and excited and especially appreciated the hands-on aspects of the projects as well as their experiences with role models. Providing agency to the students, allowing them to do what they chose to do, was mentioned by a few educators as being powerful for their students. In addition to the positive responses, students also experienced frustration. Educators reported some students being frustrated when having to collaborate and when testing materials. Interestingly, more than one educator mentioned that their female students provided more feedback than male students so they had a better sense of how the project worked for those students.

The most common response to ‘what worked’ was implementing hands-on or open-ended activities, mentioned twice as often as any other response. Having role models and facilitating creativity were also mentioned by multiple educators. Other elements that ‘worked’ mentioned by individual educators include going into the community, students being able to work with their friends, using credentialed teachers who are trained on the *SciGirls Seven*, and having the curriculum ‘ready to go’.

The most common response to ‘what did not work’ was collaboration. Some students did not want to collaborate or it was difficult for them. Educators found it difficult to encourage equality in group work and to keep it non-competitive. Effective group work, especially with respect to equity, is not easy to facilitate and requires thoughtful planning and execution. As one educator simply stated, “*Collaboration is difficult.*” A number of educators also mentioned capacity issues such as not having enough educators for the students they serve (or want to serve), not having adequate training, or not having buy-in from staff. A few educators experienced issues related to programming not being age-appropriate and limitations due to location, such as not being able to view the *SciGirls* videos.

## **Impact on educators**

During panel presentations and small group discussions at the *SciGirls Reflect* event, educators discussed benefits of the *SciGirls* training and resources, implementation challenges, and the benefits and challenges of *SciGirls*' focus on girls.

Educators appreciate both the comprehensiveness of the *SciGirls* resources (various activities and strategies to work with, research-based) and the ease of use (one go-to document, materials are available anywhere). This was a consistent theme throughout the day. Particular elements of the resources that educators cite as beneficial include facilitating collaboration, being inquiry-based, and focusing on role models. Educators also mentioned that *SciGirls* training and resources help them reach non-STEM educators and they believe *SciGirls* resources empower educators and help increase their confidence.

Some educators voiced concern over *SciGirls* having 'girls' in the name, making it more challenging to appeal to co-ed programs and participants, and asked about authentic ways to show that the resources and teaching strategies really are effective for all youth. One educator offered the statement, 'girl-focused, boy-friendly' as one way to potentially respond to this challenge. Educators also pointed out that *SciGirls*' gender equitable teaching strategies cut through the girls-only criticism because they are strategies that benefit everyone.

Other challenges discussed include high level issues such as alignment with state standards or a state not adopting the Next Generation Science Standards (NGSS), resistance to believe there are issues with girls and STEM, and lacking administration buy-in. For educators on the ground, challenges included motivating teachers to attend trainings, the length of the training, time, finding STEM mentors, and the challenges for teachers to experiment and do inquiry given constraints of the classroom.



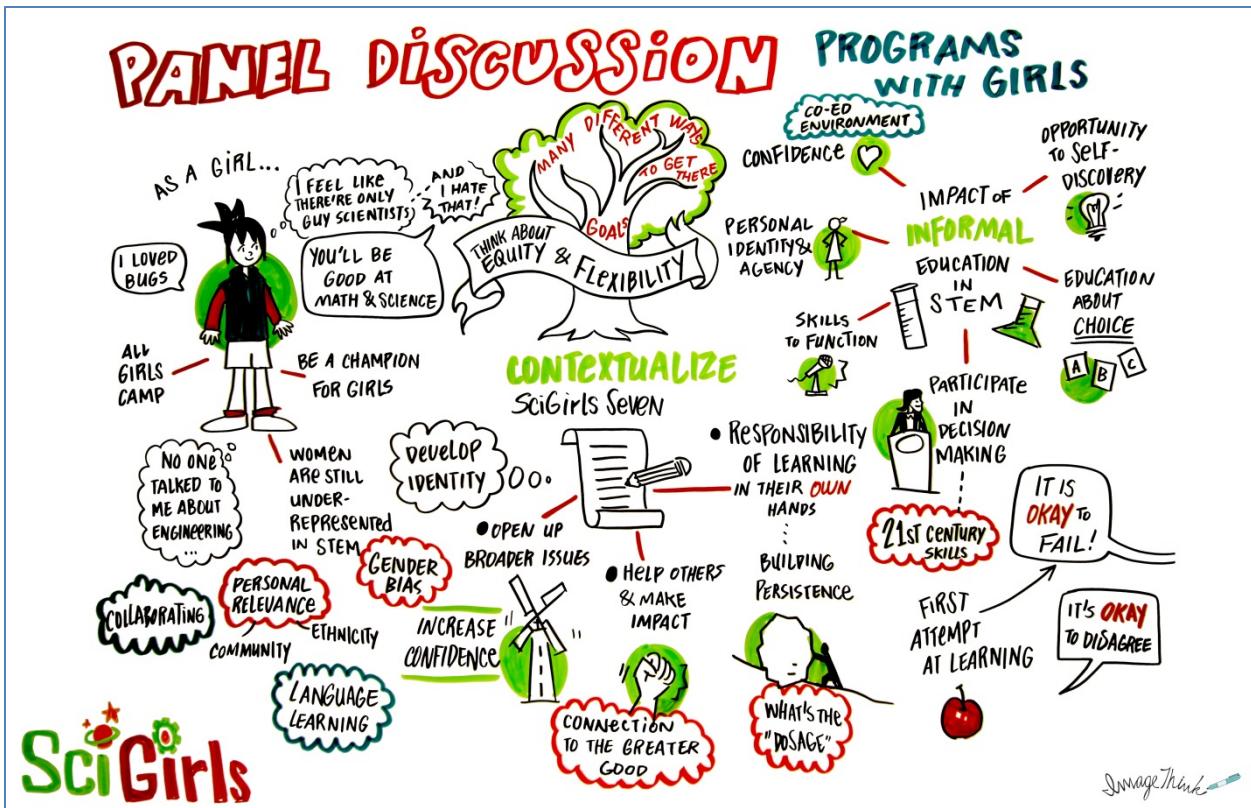
During the interview activity, educators were asked what impact planning and implementing the project had on them as educators. Educators' responses were powerful, citing personal impacts as well as impacts on their teaching and/or capacity to run a program. Educators reported their planning and implementation of a *SciGirls* project or activity helped them to build confidence, be flexible, and reinforced what they believed to be important related to teaching STEM and using the *SciGirls Seven* strategies. One educator stated, "*It reinforced my concept that organized chaos is the way to go with STEM if possible*", supporting the use of hands-on, open-ended projects and allowing students to be creative. Multiple educators mentioned that having turnkey activities was critical to their success and having vetted, research-based activities make them easier to implement. A few educators reported farther reaching impacts, such as making gender equity a top priority in their organization and focusing on creating an inclusive environment dedicated to girls' experience.

### **Impact on youth**

Many of the benefits for youth, girls in particular, that were presented and discussed during the panel presentations and small group discussions directly related to the *SciGirls Seven* strategies. For example, exposure to role models, having the opportunity to make their own decisions, engaging in critical thinking, collaborating, and learning it is okay to fail were all mentioned throughout the day. Many of the challenges that were cited relate to the *SciGirls Seven* strategies as well, and some overlap with benefits. Educators discussed challenges for girls relating to role models, not being able to assume what is relevant for girls you are working with, collaborating, and engaging in open-ended activities.

*SciGirls Reflect* participants discussed longer-term benefits they believe their students are experiencing as well, including positively impacting students' identity, confidence, persistence,

and interest in STEM. Other challenges noted were students not being able to afford programs, not enough dosage, gender bias, and time.



Similar themes emerged in the interview data related to impact on students. A number of educators reported that the project example they implemented positively impacted their students' confidence, was empowering, and helped their students question the possibilities for themselves (and what they are capable of). One educator mentioned that it also increased parents' confidence and they became more thoughtful about how to engage with youth related to STEM. Educators reported many positive impacts related to students' process of learning. For example, students were able to problem solve and think critically, were in a safe environment and learned it was okay to fail, had the opportunity to think outside of the box and engage as scientists in asking questions like 'why'. Some educators reported the experience positively impacted their students' STEM identity and increased their interest in STEM.

Educators also reported that the projects impacted students' awareness of college and careers, including becoming more comfortable navigating a college campus, making connections with scientists, and becoming more aware of STEM careers. One educator felt their students gained new friendships

*“SciGirls curriculum provides a space for girls to reflect on their own abilities, interests, and potential.”*

## *-SciGirls Reflect participant*

and networks beyond their socioeconomic status and cultural communities and another reflected on the positive impact of students seeing that art and science can go together.

Similar to *SciGirls* educators' beliefs about the impact of using the *SciGirls Seven* strategies, educators in the NGCP community have reported their use of exemplary practices has led to positive outcomes in their program, including more effectively serving girls, increasing girls' interest and confidence in STEM, and increasing positivity of girls' attitudes toward STEM (Liston & Coulon, 2016). However, previous findings from *SciGirls* educators identify STEM content-related benefits more often than *SciGirls Reflect* educators, citing STEM content knowledge and scientific inquiry and process skills as the top two benefits to youth participating in *SciGirls* activities (Knight Williams, Inc., 2014).

## Action Research Project: *Broadening the Discussion* findings

A unique feature of the *SciGirls Reflect* project was the opportunity for participants to conduct an Action Research Project in their local communities following the in-person event. Eighteen participants interviewed a total of 22 *SciGirls* trainers and educators as part of the Action Research Project: *Broadening the Discussion*. *SciGirls Reflect* participants primarily chose educators to interview who they had trained on *SciGirls* curriculum or educators who they currently worked with. The *Broadening the Discussion* interview protocol focused on the impact of *SciGirls* on the educators and on the youth they serve as well as challenges that both groups have experienced. Many of the themes that emerged were similar to those from the in-person event, but there were also some interesting differences. (See Appendix B for the Broadening Discussion project directions and questions.)

### Impact on educators

Educators who participated in the *Broadening the Discussion* interviews cited many benefits and positive impacts of the *SciGirls* training and the *SciGirls Seven* strategies on themselves and their teaching. In addition to the following summary, it is important to note that two educators involved in the interviews, both K-12 teachers who are not certified *SciGirls* trainers and who do not run *SciGirls* programs for girls, did not report experiencing positive impacts of *SciGirls*.

Having the *SciGirls* curriculum, strategies, and resources available and packaged how they are is incredibly valuable to educators. This was a theme that was heard during the in-person event as well as throughout educators' comments during interviews. The resources were mentioned consistently as one of the most beneficial pieces of *SciGirls*, but there was also a focus on how they are presented. The fact that educators can take the strategies, activities, videos and use them easily (and share with others) is appreciated. The *SciGirls* resources also help educators plan more efficiently and effectively.

Beyond having the resources available and in user-friendly formats, many educators commented on the importance of *SciGirls* being research-based. Educators feel this increases

*"It (SciGirls) enabled me to have an arsenal of engaging STEM activities that are educational and fun for the girls. SciGirls Seven provided a sounding board for me to produce well-rounded activities for all types of learners."*

*-Broadening the Discussion participant*

their confidence in using and sharing the resources, provides credibility to what they are doing, and assures them that if they use the strategies and resources, they should be effective in engaging girls in STEM.

When educators were asked if *SciGirls* helped them feel more confident, the answer was a resounding ‘yes’. Many educators pointed again to the significance of *SciGirls* being research-based in contributing to their confidence. It is very important to these educators to know that they are using research-based, proven practices and curriculum.

Educators acknowledged how the *SciGirls Seven* strategies align with effective teaching practices in general. Some educators stated that they integrate the strategies into all they do and others mentioned they are very helpful as a ‘framework’ for their work. *SciGirls* has also helped educators be more intentional in how they teach overall and especially in how they work to engage girls in STEM. Educators have started to incorporate specific strategies as the result of *SciGirls* that they report having an impact on their work, especially incorporating hands-on, open-ended activities, personally relevant content, utilizing role models, and providing specific feedback. One educator stated, “*I have learned to be more of a facilitator rather than teaching my heart out to a class of head nodders.*”

In addition to the benefits, educators shared challenges they have experienced when implementing the *SciGirls Seven* strategies. Educators reported not always having enough time to either plan or implement their activity or program, sometimes having difficulty accessing the materials needed, and struggling with making activities appropriate to the age group they were working with (especially when working with a large age-range). Specific *SciGirls* strategies also bring challenges, including having open-ended activities, finding role models, and making content relevant. Some educators expressed difficulty in keeping students engaged and struggle with disruptive students in general.

Educators were asked if they faced specific challenges when trying to implement the *SciGirls Seven* with youth from diverse racial, ethnic, or socioeconomic backgrounds. Although some educators responded that they either didn’t work with a diverse group of youth or didn’t face specific challenges in this area, many responded that they did. Challenges included youth (and others) having preconceived bias about STEM and who pursues it, letting go of gender and socioeconomic stereotypes, lack of role models in their community or social circles, and not having strong support systems. Socioeconomic issues were also cited as a challenge for students to participate in programs and transportation issues make it difficult for some youth to get to programs.

## **Impact on youth**

During the *Broadening the Discussion* interviews, educators were asked if the use of the *SciGirls Seven* strategies has an impact on students’ interest and motivation to pursue a STEM career. Some educators responded yes while some were hesitant to claim a direct correlation, but most believe it is a step in the right direction or is at least opening the door for girls and young women to consider a STEM career.

Educators acknowledged that choosing a career is a huge decision and many factors impact that decision and the impact of *SciGirls* also depends on the intensity/dosage and quality of the programming they experience. Many educators

*“They start to think critically and start to ask questions, they start to see themselves behaving like scientists.”*

*-Broadening the Discussion participant*

mention the importance of role models in increasing awareness of STEM careers for girls and helping them see that they a STEM career might be an option for them.

Educators expressed overwhelming agreement that the use of the *SciGirls Seven* strategies helps girls see themselves as the type of person who can succeed in STEM. Many educators cited the significant role of role models in this process, which is just one of the *SciGirls Seven* strategies, but obviously one that educators connect to outcomes for the girls they serve. Educators also mentioned the importance of girls experiencing success in STEM activities and programs. This is even more powerful when success is the result of something the girls have done on their own. Treating girls with respect, giving them specific feedback, and making STEM relevant to them were all cited as important program components that facilitate girls seeing themselves as someone who can succeed in STEM.

Educators definitely see the connection between the *SciGirls Seven* strategies and development of 21<sup>st</sup> Century skills. They emphasized collaboration, critical thinking and problem solving in particular. It is worth noting that many of the *SciGirls Seven* strategies relate to skills that educators find important for students' futures, especially related to careers.

Educators were asked if they could think of an example in which incorporating the *SciGirls Seven* strategies helped their students counteract gender bias and/or gender stereotypes. Many educators responded positively, but some did not have an example or were not sure this was happening in their environments. Many of the examples provided related to role models and the impact of exposing girls (and boys) to women STEM professionals, both live and via video. A few examples related to girls and boys working together and both groups seeing that girls are capable at STEM, and one educator cited a positive change in her students' drawings of scientists post-program (more likely to draw women scientists).

During the interview, educators were asked to relay the impact of a project example that incorporated *SciGirls* strategies and/or resources on their students. Educators mentioned both short-term and long-term impacts. Awareness and confidence were the most common responses. Educators reported that their students' awareness of STEM and STEM careers in general as well as awareness of the options open to them related to STEM were positively impacted. Many educators felt their students (girls in particular) increased in confidence and some felt their students learned STEM content. Some educators stated future impacts such as girls being more interested in and pursuing additional STEM opportunities and potentially being more interested in STEM studies and careers. A couple educators who work in co-ed settings mentioned that breaking down gender stereotypes and raising awareness of gender issues in STEM were benefits their students experienced.

Educators were tremendously positive overall about the impact of *SciGirls* on their students, but their students also experience challenges with *SciGirls Seven* strategies and programming. The *SciGirls* strategies that presented the most challenges for students were Strategy #4: *Girls are motivated when they can approach projects in their own way, applying their creativity, unique talents, and preferred learning styles*, Strategy #6: *Girls gain confidence and trust in their own*

*Girls participating in  
SciGirls type activities  
gain confidence in  
themselves, and their own  
understanding of scientific  
concepts.*

*-Broadening the  
Discussion participant*

*reasoning when encouraged to think critically*, Strategy #3: *Girls enjoy hands-on, open-ended projects and investigations*, and Strategy #1: *Girls benefit from collaboration, especially when they can participate and communicate fairly*. Interestingly, for strategies related to approaching projects in their own way, critical thinking, and open-endedness, educators commented on the fact that students do not have much opportunity to practice these skills in the formal classroom, so can find it challenging when provided the opportunity to work in these ways.

Additional challenges for students included not having a strong foundation or confidence in STEM. This can make it difficult to attract students to the program initially and to provide effective programming. Girls in particular were noted for lacking persistence, especially in the face of failure. Some educators observed that it can be challenging for girls to accept and understand that failure is okay, is part of the process, and to persist. One educator stated, “*The biggest challenge is the girls wanting to give up after a small failure.*” Challenges related to access, including location and cost, were also mentioned.

Overall, educators cite a host of valuable benefits for students participating in programs that incorporate the *SciGirls Seven* strategies. On the top of the list are increased confidence, engagement, and interest in science or STEM. Educators express that the students they work with, girls in particular, develop more confidence in themselves, especially related to STEM. Part of this derives from being successful, realizing they can do STEM, and seeing other girls do it too. A number of educators specifically point out the power for girls in their programs in being with other girls who are interested in and doing STEM. At a higher level, educators also mentioned how having a program focused on girls and STEM in itself is beneficial, especially when there is a positive, supportive learning environment. This learning environment is not unique to *SciGirls* programs, but educators note that using the *SciGirls Seven* strategies creates a positive, supportive environment and this may not always be true for other experiences their students have. Educators also mentioned their students having an increased awareness of careers and future possibilities in STEM as a result of their programs.

### ***Broadening the Discussion* reflections**

Educators who conducted *Broadening the Discussion* interviews were very likely to notice common themes between the experience of the educator who they were interviewing and their own experience. Common themes included working in similar contexts, utilizing *SciGirls* in similar ways, seeing similar impacts on girls they serve, and citing specific strategies that they use most and find most valuable. Educators noted differences in their experiences as well, especially relating to working with different populations or in different contexts and their students' level of engagement and confidence.

Although not all, many educators heard something from those they interviewed that they had not thought of previously. A number of comments related to working in different contexts (formal classroom vs. afterschool program; all-girls program vs. co-ed program) and some related to having different perspectives on *SciGirls* strategies and resources or gender equity in STEM overall. Educators were very positive about their experiences conducting the *Broadening the Discussion* interviews. Many educators appreciated learning about the impact of *SciGirls* in others' programs, realizing the value of *SciGirls* beyond their own program or organization, and having the opportunity to stop and really talk with a *SciGirls* educator about their mutual work.

## Moving forward

*SciGirls Reflect* produced a variety of rich data that demonstrates the impact of *SciGirls*, identifies challenges, and provides ideas for moving forward. In addition, participants of the in-person event benefitted from the opportunity to both personally reflect on their experiences with *SciGirls* and to learn from a colleague about their experiences. *SciGirls Reflect* participants, both those who attended the *SciGirls Reflect* in-person event and those who participated in *Broadening the Discussion* interviews, provided valuable information about the impact *SciGirls* has had on them, their teaching, and their students.

Based on the *SciGirls Reflect* participants' insights, the following ideas are presented for *SciGirls* to consider moving forward.

- The impact of *SciGirls* on educators and youth is substantial and has the potential to extend beyond the educators and youth directly involved in *SciGirls* programming. It is important to continue to bring *SciGirls* resources to educators, building their capacity to engage girls in STEM, and to respond to challenges that *SciGirls Reflect* participants expressed.
- The *SciGirls Seven* strategies are valuable and accessible, especially the core strategies that most educators report using. Educators report that they and their students are positively impacted in multiple ways by the use of the *SciGirls Seven* strategies. Although effective and evidence-based, the strategies can also be challenging to implement, especially when they present a different way of teaching and learning than youth may experience in other educational environments (ex. open-ended, collaborative, youth-driven). This presents an opportunity for *SciGirls* to continue to build educators' knowledge and skills in a deeper way by providing more in-depth resources and training on the strategies and their implementation.
- Role models have the potential to significantly impact girls in STEM by increasing their awareness of STEM careers and opening the door to future possibilities. Incorporating role models into programming needs to be done well to be effective and there are challenges related to identification of role models and training for both educators and role models to make the experience beneficial for the youth involved. This is an area for *SciGirls* to continue to focus on and build capacity for educators and role models to encourage girls in STEM. Research on role models, especially related to the impact role models have on girls in STEM, would also be valuable to inform the field and future *SciGirls* programming.

Despite some challenges, the *SciGirls Reflect* participants were overwhelmingly positive about the *SciGirls* resources and strategies and have a wealth of experience incorporating *SciGirls* in their programs and organizations. It is clear that, in addition to specific outcomes for educators and students, *SciGirls* has the potential to impact teaching practice and the bigger picture of STEM education. Educators report significant impacts to their teaching practice and how they think about STEM, including integrating the strategies into all they do and prioritizing engaging girls in STEM. Educators and organizations are starting to incorporate *SciGirls* strategies and philosophy into their programs and organizations which can have a much larger and potentially systemic impact on how those programs and organizations provide STEM opportunities to youth. As one educator stated, “(*SciGirls was*) *instrumental in having me look at a different approach to education and pushing me to ensure all of my learners were valued.*”

## References

Knight Williams, Inc. (2014). *Evaluation of SciGirls Season Two Outreach Program*. Sacramento, CA: Author.

Liston, C. & Coulon, V. (March, 2015). *National Girls Collaborative Project Annual Evaluation Report*. Waltham, MA: Education Development Center.

Liston, C. & Coulon, V. (February, 2016). *National Girls Collaborative Project 2015 Participant Survey Summary*. Waltham, MA: Education Development Center.

## Appendix A: *SciGirls Reflect* Agenda



### ***SciGirls Reflect* Agenda**

**Wednesday, December 2, 2015**

**Seattle, WA**

<b>Time</b>	<b>Topic</b>	<b>Location</b>
10:00 – 10:30 AM	<b>Welcome and Opening Remarks</b>	Hotel
10:30 – 11:45 AM	<b>Panel and Small Group Discussion about the SciGirls Seven and Educators</b>	Hotel
11:45 AM – 12:00 PM	<b>Break</b>	Hotel
12:00 – 12:45 PM	<b>SciGirls Seven Discussion in Affinity Groups</b>	Hotel
12:45 - 1:30 PM	<b>Lunch with Evaluation Presentation by Dr. Roxanne Hughes</b>	Hotel
1:30 – 2:45 PM	<b>Panel and Small Group Discussion about the SciGirls Seven and Youth</b>	Hotel
2:45 – 3:30 PM	<b>Broadening the Discussion</b>	Hotel
3:30 – 3:45 PM	<b>Evaluation</b>	Hotel
3:45 – 4:00 PM	<b>Closing Remarks</b>	Hotel
4:20 – 5:00 PM	<b>Transportation to Evening Event</b>	Museum of Flight
5:00 – 8:00 PM	<b>Evening Event at the Museum of Flight</b>	Museum of Flight

## **Appendix B: *Broadening Discussion* Project Directions and Questions**



### **Broadening the Discussion Action Research Project Directions**

1. Choose a *SciGirls* educator who did not attend the *SciGirls Reflect* event to interview. Schedule at least 1 hour to complete the interview (in person if possible).
2. As you conduct the interview, please record the educator's responses in the online form (<https://kat102.typeform.com/to/ssDPqp>). Please include all questions and do not summarize the educator's responses.
3. After you have completed the interview, please respond to the personal reflection questions in the online form (<https://kat102.typeform.com/to/BRIvQN>).
4. Submit interview data and your personal reflections via the online forms by COB January 15<sup>th</sup>, 2016. Thank you!

## Broadening the Discussion Action Research Project Questions



### **SciGirls Strategies: Overall Impact**

1. What benefits (if any) did you experience as the result of the *SciGirls* training and/or use of the *SciGirls Seven* strategies?
  - Did the *SciGirls* training and/or use of the *SciGirls Seven* strategies help you feel more confident and successful in reaching and engaging girls (and boys) in STEM? If so, how?
  - Did the *SciGirls* training and/or use of the *SciGirls Seven* strategies have an impact on the way you plan, organize, and communicate your program/lessons?
2. What challenges or barriers (if any) did you experience when implementing/trying to implement the *SciGirls* strategies?
  - To what extent do you implement the *SciGirls Seven*? How do you implement the strategies?
3. What are the benefits (if any) for students (female students in particular) of participating in a program that incorporates the *SciGirls Seven* strategies?
  - Do you think the use of the *SciGirls Seven* strategies helps girls see themselves as the type of person who can succeed in STEM? Why or why not?
  - Do you think the use of the *SciGirls Seven* strategies has an impact on students' interest and motivation to pursue a STEM career? Why or why not?
  - To what extent do the *SciGirls Seven* foster and strengthen students' development of 21<sup>st</sup> century skills, including learning skills (critical/creative thinking, collaborating, communicating), literacy skills (including media and technology literacy), and life skills (social skills, leadership, initiative, flexibility)?
  - Can you think of an example in which incorporation of the *SciGirls Seven* in your program/curriculum helped students counteract gender bias and/or gender stereotypes?
4. What are the challenges (if any) for students (female students in particular) of participating in a program that incorporated the *SciGirls Seven* strategies?
  - Which strategies presented the most challenges for your students?
  - Did you face specific challenges when trying to implement the *SciGirls Seven* with youth from diverse racial, ethnic, or socioeconomic backgrounds?

## **SciGirls Strategies: Project Example**

5. Please describe a successful project, lesson plan, or activity you have implemented with students using the *SciGirls Seven* strategies and/or *SciGirls* resources including, but not limited to, the following:
  - Describe the population (ex. number of students, all-girls or co-ed, socioeconomic status, race/ethnicity)
  - Describe the environment (ex. in school, after school, summer program)
  - What did you do/how did you implement *SciGirls Seven* strategies?
  - Which strategies or resources did you use?
  - How did your students respond? For mixed group settings: Did the girls and boys respond in any different ways?
  - What worked?
  - What didn't work?
6. Overall, what impact do you think the project, lesson plan, or activity had on your students? For mixed group settings: Do you think girls and boys were impacted in different ways?
7. Overall, what impact did planning and implementing the project, lesson plan, or activity have on you as an educator?