SciGirls CONNECT²

Formative evaluation of educators' use of the *SciGirls Seven* strategies in Year 1

Knight Williams, Inc.

Valerie Knight-Williams, Ed.D.
Divan Williams Jr., J.D.
Rachael Dobrowolski, MESc
Abigail Simmons

March 2018

Knight Williams Inc.

Table of Contents

Significant findings

The independent evaluation firm, Knight Williams, Inc., administered an online survey and conducted follow-up interviews with educators from 14 *SciGirls CONNECT²* partner organizations to gather information about their use of, reflections on, and recommendations relating to the *SciGirls Seven* strategies. The evaluation aimed for two educators from each partner organization – specifically the program leader and one educator who was familiar with the *SciGirls Seven* – to share reflections on the strategies after they completed their Year 1 programs. In all, 24 educators from 13 partners completed the survey, for a response rate of 86%. Additionally, 20 of the educators who submitted the formative survey went on to complete the follow-up interview, for a response rate of 83%.

More than half of the educators self-identified as *SciGirls CONNECT²* program leaders, while smaller groups said they were primarily educators or described holding other roles. The number of years educators had worked at their organizations and implemented STEM programming for girls ranged considerably, in both cases from less than a year to more than 10 years. In terms of their experience with the *SciGirls Seven*, about a third each had been working with the strategies for a year or less, two to four years, or five to eight years. Key findings that emerged regarding these educators' use and perception of the *SciGirls Seven* in their Year 1 programs are summarized below.

Perceived goal of the SciGirls Seven
When asked to describe the overall goal of the *SciGirls Seven,* more than two-thirds of the educators reported that it was to engage girls in STEM, generally matching TPT's envisioned goal for the strategies. Smaller groups said that the strategies were also intended to inspire careers in STEM, be a tool for educators, and/or show girls a new way of learning. When subsequently asked to reflect on their own use of the *SciGirls Seven* in Year 1, and whether they felt the overall goal of engaging girls in STEM was reflected strongly in the strategies, all of the educators agreed that it was.

How the SciGirls Seven were considered in program planning and implementation
More than half of the educators who addressed how they considered the *SciGirls Seven* when planning and implementing their Year 1 programs said they tended to prioritize one or more of the strategies consistently. More than one-third, meanwhile, tended to use the strategies synergistically/as a set , while one-fifth tended to use different strategies in different situations.

Primary SciGirls Seven sources that facilitated planning and implementation
On average, the educators relied on two primary *SciGirls* sources to facilitate their program planning and implemention. Three-quarters pointed to the *SciGirls Seven* complete guide and nearly two-thirds pointed to the *SciGirls Seven* two-page reference. Smaller groups pointed to the *SciGirls Seven* postcard, the gender equity training, their own notes, or another source.

SciGirls Seven strategies used most and least often
When asked to identify the strategies they used most often, the educators listed between one and six strategies each, though on average they listed two strategies, and no one strategy was mentioned by a majority of educators. The largest groups pointed to two strategies, strategies #1 and #3 (see Appendix 1 for strategy details), around which some educators described girls' positive responses to these strategies or cited their ease of use. Smaller groups pointed to each of the five remaining strategies or said all strategies were embedded to an equal extent.

As for strategies used least often, in this case the educators listed between one and three strategies each, though on average they listed one strategy, and here again, no one strategy was mentioned by a majority of educators. The largest group pointed to strategy #7, while smaller groups pointed to each

of the six remaining strategies. Some who reported using strategy #7 least often noted that they had trouble finding role models or making the most of their visits.

Extent to which SciGirls Seven strategies were considered redundant or best used in combination
Nine-tenths of the educators reported that they did not find any of the *SciGirls Seven* strategies to be redundant as applied in their Year 1 programs, and one each said they found strategies #1 and #4 redundant. When asked if there were any strategies that were best used in combination, no one specific combination was mentioned by the majority of educators and nearly one-third declined to identify any strategies best used in this way. Among those who did suggest a combination, nearly one-third pointed to strategies #2 through #4, with most in this group specifically suggesting strategies #2 and #4. One-quarter of the educators thought strategies #5 and #6 could be combined, and smaller groups suggested combining #1 and #3, or shared miscellaneous suggestions.

Whether girls were informed of the SciGirls Seven
Just over half of the educators said that they had informed their girl participants about the *SciGirls Seven,* some of whom thought doing so could increase girls' (and parents') awareness of their learning and growth or might be useful to them beyond the *SciGirls CONNECT²* program.

Resources that facilitated implementation of the SciGirls Seven
When asked to identify which, if any, *SciGirls* resources were most useful in facilitating their implementation of the *SciGirls Seven*, no one resource was named by the majority of educators. Just under half pointed to the activities, while smaller groups cited the CONNECT website and the *SciGirls Seven* sources, among others.

Perceived value and impact of the SciGirls Seven
The educators generally rated all seven strategies *extremely valuable* and reported they had observed each strategy result in the key outcome TPT envisioned. Specifically, most educators said they saw strategy #2 motivate girls, strategy #3 help girls enjoy participating, strategy #4 motivate girls, strategy #5 improve girls' confidence, strategy #6 improve girls' confidence and trust in their own reasoning, and strategy #7 inspire and motivate girls. The majority also saw strategy #1 energize girls.

Beyond observing the individual strategy outcomes that TPT envisioned for each strategy, most educators further reflected that, as a result of using the strategies, they had observed an impact on girls' STEM identity as defined by the *SciGirls CONNECT²* project. Their responses tended to focus on what they observed about the individual components of STEM identity, per the definition provided, rather than on their integration. Specifically, three-fifths each said they saw an increase in girls' confidence and/or an increased engagement with or interest in STEM, while two-fifths observed an increased interest in STEM careers/professionals. When the educators were asked to consider whether any strategies were particularly important in facilitating the impacts they identified, between one-quarter and two-thirds pointed to each of the seven individual strategies. Their responses also indicated that strategies #7, #3, #1, and #4 may have played a heightened role.

Suggested revisions, additions, and other recommendations to the SciGirls Seven
When invited to share proposed revisions, educators commented on five topics addressed in the current *SciGirls Seven*: relevance (including cultural relevance), collaboration, role models, positive feedback, and preferred learning styles. When invited to share proposed additions, a few each suggested incorporating real-world STEM work contexts or commented on growth mindset. Finally, when invited to share other recommendations for the *SciGirls Seven*, between one and three educators commented on each of the following topics: incorporating art in STEM, incorporating other topics, working with younger girls, strengthening educator resources or trainings, and increasing parental involvement.

Introduction

Project background and goals

SciGirls CONNECT²: Investigating the Use of Gender Equitable Teaching Strategies in a National STEM Education Network is a three-year Research in Service to Practice project directed by Twin Cities Public Television (TPT) and funded by the National Science Foundation Division of Research on Learning. As summarized on the [SciGirls CONNECT² website](#), the project will produce an updated set of [SciGirls Seven](#) strategies, a set of seven strategies used by informal educators in diverse settings since 2010 to help engage girls in STEM studies and careers.

To achieve this goal, TPT is working with an advisor group, an independent evaluation team from Knight Williams, Inc., a research team from the Center for Integrating Research & Learning of Florida State University, and a cohort of informal STEM education organizations to: 1) evaluate educators' use and perceived effectiveness of the *SciGirls Seven* with diverse girls in informal STEM settings; 2) conduct a comprehensive literature review of the latest gender equity research; and 3) implement a research study investigating the impact of the *SciGirls Seven* on girls' STEM identity. At the end of the project, TPT will disseminate the literature review, research and evaluation findings, and the updated set of *SciGirls Strategies* to practitioners and researchers in the informal STEM education field.

Outreach program requirements

SciGirls CONNECT² partner organizations were required to include several program components outlined for the partners on the [SciGirls CONNECT² website](#), including:

- Offer a 16-32 hour *SciGirls* program for at least 10 girls ages 8-13
- Include at least three female role models
- Include the creation of short videos created by girls in pairs or groups, about their STEM experiences
- Hold one culminating event for girls and families each year to engage families and girls in hands-on activities, sharing of learning, media viewing, and meeting female STEM role models

Relating to the *SciGirls Seven*, the focus of this report, the partners were required to address the strategies as follows:

- In Year 1 (April-December 2017) use existing *SciGirls Seven* strategies
- In Year 2 (April-December 2018) use updated *SciGirls Strategies*

Image 1 provides a brief summary of the *SciGirls Seven* and Appendix 1 presents the longer two-page reference.

Image 1. The *SciGirls Seven* ([courtesy of TPT](#))

Role of independent evaluation

For the *SciGirls CONNECT² * project, the role of the independent evaluators from Knight Williams, Inc. is "to gather, analyze, and summarize data that can facilitate the project's effort to revisit, refine, and expand the *SciGirls Seven* and related strategies … [prioritizing] methods that are interactive and iterative in nature over the grant period" (NSF proposal, 2015). Using front end, formative, and implementation processes, the evaluation team has and will continue to: 1) provide the project and research teams with relevant information at key points during the grant period, such that both teams have regular access to data on the educators' experience with the strategies that can be used to inform the project's research and practice initiatives; and 2) provide ongoing documentation and assessment of *SciGirls CONNECT² * project activities to help assess progress in achieving the grant's stated objectives.

As part of the project's independent formative evaluation, the evaluation team administered an online survey and conducted follow-up interviews with educators from the *SciGirls CONNECT² * partner organizations at the end of their Year 1 programs. The purpose of the evaluation was to gather information about the educators' use of, reflections on, and recommendations relating to the *SciGirls Seven* to help inform the updating of the strategies.[1]

Report outline

This report presents findings on the *SciGirls CONNECT² * outreach program educators' experience with and recommendations relating to the *SciGirls Seven* strategies, as implemented in their Year 1 programs. The findings are presented in two parts: Part 1. Use and perceived value of the *SciGirls Seven* strategies in Year 1 and Part 2. Suggestions for *SciGirls Seven* strategies.

Method

The evaluation aimed for two educators from each partner organization – specifically the program leader and one educator who was familiar with the *SciGirls Seven* – to provide post-program reflections on their use of the *SciGirls Seven* and suggestions for refinement. As the partners completed their Year 1 programs, between June and December of 2017, Knight Williams sent them an invitation to complete an online survey hosted on the firm's independent server. After submitting their surveys, each educator was asked to schedule a follow-up phone interview with a member of the evaluation team. Depending on the depth of their feedback, the interviews lasted 15-45 minutes, with most taking 20-25 minutes.

Analysis

Basic descriptive statistics were performed on the quantitative data generated from the evaluation. Content analyses were performed on the qualitative data generated in the open-

---

[1] A separate report from Knight Williams, *SciGirls CONNECT² Implementation evaluation: Year 1 outreach programs*, considers: educators' Year 1 program reporting; the perceived impact of Year 1 programs, resources, and role models; and the highlights and challenges of Year 1 family events and video projects.

ended questions. The analysis was both deductive, drawing on the project's goals and objectives, and inductive, looking for overall themes, keywords, and key phrases. All analyses were conducted by two independent coders. Any differences that emerged in coding were resolved with the assistance of a third coder.

Response rate

Partner representation
Although the evaluation initially intended to examine the activities of 16 partner organizations, two organizations were unable to implement Year 1 programs and one did not complete the evaluation by the project deadline; thus, only 13 of the 14 partner organizations that completed programs are considered in this report. Further details are provided below.

Formative survey response
The evaluation aimed for two educators from each of the 14 partner organizations that completed programs to complete the formative survey, for a total of 28 educators. In all, 24 educators completed the survey, for a response rate of 86%.[2] Eleven of the 14 partner organizations submitted two surveys each, and two organizations submitted one survey each. Despite multiple requests from the evaluation team and TPT, one partner had yet to submit any surveys by the project deadline, resulting in 13 rather than 14 partner organizations being represented in this report.

Follow-up interview response
In all, 20 of the 24 educators who submitted the formative survey went on to complete the follow-up interview, for a response rate of 83%. Nine of the partner organizations had two educators conduct their follow-up interviews, and two partner organizations were represented by one educator.

Educators' location, role, and experience
at the partner organizations

Location
Image 2 shows where the *SciGirls CONNECT²* programs were held. The programs took place in 12 different states across the United States and the District of Columbia, although the majority were based in East coast states (62%).
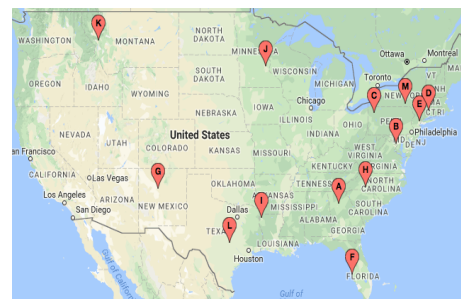

Image 2. *SciGirls CONNECT²* program locations

---

[2] In 22 cases, the educators who completed the survey were also those who had filled out a front-end evaluation survey before beginning their Year 1 programs. Where relevant, information provided in the pre-program survey is shared in this evaluation.

Role at organization

Figure 1 shows the educators' roles at their organizations. The majority of educators identified as program leaders (58%). Smaller groups said they were primarily educators (29%) or described holding other roles (13%), such as *Operations Director*, *Outreach Coordinator*, or *program volunteer*. In a few cases, the role of program leader seems to have been shared by two individuals from the same organization.

Experience at organization

Figure 2 shows the educators' years of experience at their organizations. For whom this information was available (22/24), the largest group had 2 to 4 years of experience (41%), while smaller groups of about one-fifth each indicated they had 0 to 1 year, 8 to 10 years, or more than 10 years of experience (18% each). A small group (5%) reported having 5 to 7 years of experience.

Experience engaging girls in STEM

Figure 3 shows educators' years of experience engaging girls in STEM. For whom this information was available (20/24), the largest group had 2 to 4 years of experience (50%), while smaller groups had 0 to 1 year of experience (10%), 5 to 7 years (15%), 8 to 10 years (5%), or more than 10 years of experience engaging girls in STEM (20%).

Experience using the SciGirls Seven

Figure 4 shows educators' experience using the *SciGirls Seven*. For whom this information was available (20/24), more than a third each had 0 to 1 year (35%) or 2 to 4 years of experience (35%), while less than a third had 5 to 8 years of experience with the strategies (30%).

Some of the educators went on to elaborate that their experience with the strategies went beyond their personal introduction to *SciGirls*, as in: "*I just have always used those strategies, but thinking of them in terms of the SciGirls Seven [is more recent]*" and "*We didn't call them the SciGirls Seven, because SciGirls didn't exist, but we've been using those same strategies since our program was founded [a number of] years ago ... It didn't really necessarily modify the way that we were doing things, it just gave it a framework to be able to talk about the things that we were doing, and the research behind it that we could share with others.*"

Figure 1. Educators' roles at their organizations (N=24)

Other 13%
Educator 29%
Program leader 58%
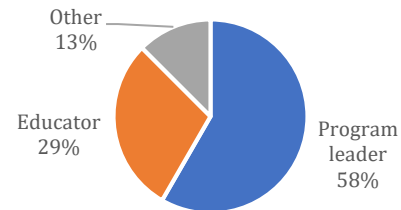
Figure 2. Educators' experience at their organizations (n=22)

More than 10 years 18%
0 to 1 year 18%
8 to 10 years 18%
5 to 7 years 5%
2 to 4 years 41%
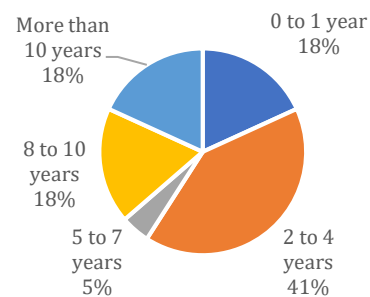
Figure 3. Educators' experience engaging girls in STEM (n=20)

More than 10 years 20%
0 to 1 year 10%
8 to 10 years 5%
5 to 7 years 15%
2 to 4 years 50%
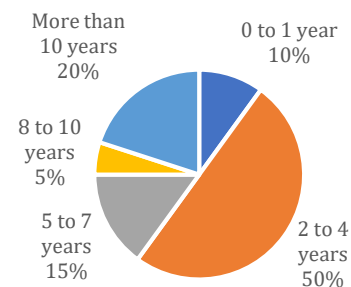
Figure 4. Educators' experience with the *SciGirls Seven* (n=20)

5 to 8 years, 30%
0 to 1 year, 35%
2 to 4 years, 35%
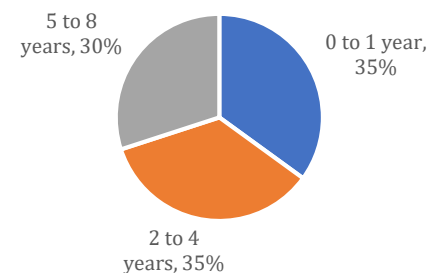
Findings

Part 1. Use and perceived value of the *SciGirls Seven* strategies in Year 1

1.1 Perception of the overall goal(s) of the *SciGirls Seven*

Figure 5 shows what educators perceived to be the overall goal(s) of the *SciGirls Seven*. Among those who identified a goal (20/24), most said the goal was to engage girls in STEM (70%). Smaller groups thought the strategies were intended to inspire careers in STEM (45%), be a tool for educators (30%), and/or show girls a new way of learning (25%). Examples of their comments are in Table 1.

Figure 5. Perception of the overall goal(s) of the *SciGirls Seven* (n=20)

Percentage of educators

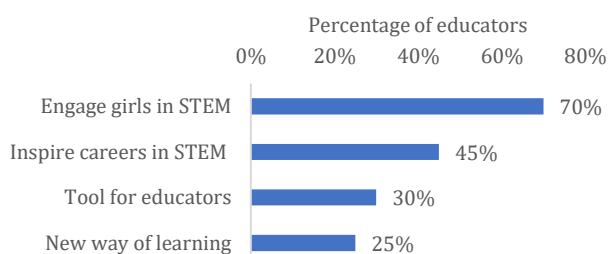|	
Engage girls in STEM	70%
Inspire careers in STEM	45%
Tool for educators	30%
New way of learning	25%

Table 1. Perception of the overall goal(s) of the *SciGirls Seven* (n=20)

Engage girls in STEM (70%)
- *I think the overall goal of the SciGirls Seven would be to engage girls in STEM learning …*
- *To help engage middle school, really all girls, any age of girls, in STEM, to get them excited about it …*
- *Motivate the girls and try to further their knowledge on what STEM really is, and that STEM can really be fun …*
- *I think the overall goal is to really spark the interest of the students, and to keep them engaged. I think that's really important … because for girls they don't really have so much access sometimes to science, they don't really get pushed to do that, so by keeping them engaged and keeping them asking questions, that's really what I think [the strategies] did.*
- *The strategies are designed to make STEM learning approachable and impactful for all, and I really like how SciGirls says they're girl-focused but everyone can participate, so just because you're doing a collaborative project it doesn't mean it's better for girls than for boys, it just levels the playing field … Having used them now for the past few years, I can honestly say there's never been any negative impact of keeping the SciGirls Seven in mind.*

Inspire careers in STEM (45%)
- *… and I also believe it's to encourage girls to be in the STEM career field.*
- *To expose women to the fact that they can be scientists. That was the biggest takeaway for me.*

Tool for educators (30%)
- *I think it makes people better educators because it gives them a purpose for the teaching they're going to be doing, so when I was a classroom teacher, there's a lot of pre-built curriculum, you must be teaching this subject, this lesson, at this time, don't stray from the book, and I really feel like the SciGirls Seven [make] teaching personally relevant for them because they're able to put their own spin on it and really be examples for the different clients and students that they serve.*
- *I think the overall goal of the SciGirls Seven would be … to train teachers on how to keep girls engaged.*
- *From an educator perspective, it really helps you to take yourself out of the occasion when you're designing a program … [the SciGirls Seven allow] you to touch that when you're designing programs, and to make sure you're designing in a way that the students are going to learn best, and not in a way necessarily that will be easiest to teach. And that can be challenging …*

Show girls a new way of learning (25%)
- *I think it also teaches them a different way to learn. Think about school – everything is standardized, everything is ABCD, everything is test-based, and this allows for a more multifaceted and sort of open-ended approach to learning which I think is far more effective at actually learning than memorizing and regurgitating.*
- *… we call it STEAM … because we bring the art in also … it perks their interest and they want to be more involved, and then use the creativity … because I think it's integral to doing science, that creative aspect is what science is all about. It isn't learning just rote memorization of information, it's creating new ideas all the time, and I constantly reinforce that with kids.*

Whether the goal of engaging girls in STEM was reflected strongly in the SciGirls Seven
In a subsequent question, educators were asked to comment on the goal of the *SciGirls Seven* in a slightly different way, reflecting on their own use of the strategies, as follows: *Thinking about the SciGirls Seven and how <u>you</u> use them, do you think the goal of engaging girls in STEM is reflected strongly in the strategies? Or is there another goal that you think the SciGirls Seven better encapsulate*? In response, all of the educators (100%) agreed that they thought the goal of engaging girls in STEM was reflected strongly in the strategies, and two of the educators pointed to an additional goal of engaging girls in learning more generally. A few elaborated that they thought the strategies were effective at engaging girls *and* boys in STEM. Examples of their comments on this topic are shared below in Table 2.

| Table 2. Whether educators thought the goal of engaging girls in STEM was reflected strongly in the strategies (n=20) |
|---|

Yes (100%)
- *I think engaging girls in STEM is the #1 goal, from all over, to participate it STEM activities and collaborate with each other on STEM projects, and motivating them to be in STEM career fields*
- *I think that is the perfect verbiage ... definitely engaging, because it sort of encompasses exposing them to science but also getting them involved in science.*
- *I think that it definitely engages them in STEM, and like I said earlier I think it also engages them in learning how to learn more effectively, in general.*
- *Each strategy really is the base for how to get the girls more engaged in science.*
- *I think that it's exactly what my thought would be, that it was engaging girls in different areas of STEM. Even the possibility was great ... My perspective [as an administrator] was, wow, my girls are thinking about themselves in such a different way.*
- *I really do [think the strategies engage girls in STEM]. I think the SciGirls Seven, that was exactly what they did. It kept them engaged, so much more so than other strategies that I've used in the past. I noticed that they were more engaged, and I saw that represented through the different types of questions that they asked ... They were asking us and the mentors a lot about, like, "How do I get to where you are?" So I know we had one mentor really shined out ... they ended up asking her what was her process to becoming a medical engineer, as far as school, even her childhood, she told us childhood stories of how she was the little engineer in her house, and how she took that interest and built it in high school, and took it to the next step in college, and now it's her career. I think that was great because her, along with the other mentors, they kind of hammered in the idea of, you want to take an interest that you already have, and use that and apply that in a STEM career. Use that as you choose a career in the future. I think that was really important.*
- *My whole thing was to get girls more engaged, because that's where my passion is. I wish I had had this information given to me as a child, I probably would be doing something different. Not that I don't love teaching, I do, but I didn't know how many opportunities were out there in STEM fields ... [Through our club] I've seen a huge increase [in girls' interest], but I've been a huge promoter of it too, so I'm not sure ... if I wasn't so willing to offer an after-school club for girls and all these opportunities, if it would be the same, but since I have implemented it I've seen a huge increase in girls' interest.*
- *[Engaging girls in STEM captures it perfectly] ... I think, even more than that, it's strategies for engaging all.*
- *I think the seven strategies do a great job of reflecting the overall strategies of STEM education, and I think that's the case because they are research-based and they are best-practices. Here, they're laid out specifically for girls, but I think these are important strategies for everyone. They're particularly important with girls but I think they apply all the time.*
- *I think that they do ... I tend to use more of some of them than others, but I think overall ... when I first met the girls I showed them the chart of how women are distributed in the STEM field and they were shocked ... just getting them thinking about that, that all of these fields are out there and women aren't in these fields, whether they don't know about it or whatever.*
- *I think [engaging girls in STEM is] what we're trying to do ... I will say a lot of times what we say when we're presenting this, so that we get the educators who are reaching boys also, is we say "strategies to engage girls and all kids in STEM" because these are best practices for all, not just girls, even though they do in particular help the girls.*
- *[I think the strategies engage girls in STEM.] I think they work both for boys and girls. I don't see them as being gender-specific, but I think what's important is that we always make sure girls are part of this, that they don't get sidelined, which can happen in a mixed group.*

1.2 Perceived value of the *SciGirls Seven*

Figure 6 shows the median ratings of how valuable educators found the *SciGirls Seven* strategies in engaging girls that participated in their Year 1 programs, using a scale from 1.0 (*not at all valuable*) to 5.0 (*extremely valuable*).[3] Those who used the strategies (n=23) generally found each strategy *extremely valuable* (*Mdn* = 5.0).

**Figure 6. Median ratings of how valuable educators
found the *SciGirls Seven* (n=23)**

Scale from 1.0 (*not at all valuable*) to 5.0 (*extremely valuable*)
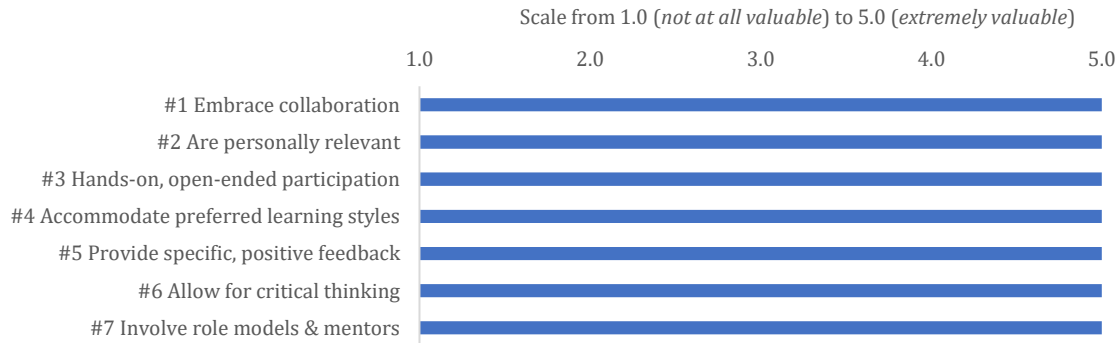
A few of the educators elaborated on various aspects of their ratings, as in:

- *All of the strategies help to develop the whole child both academically and emotionally. Having an opportunity [to] present these strategies encourages creative critical thinkers and problem solvers. These strategies foster leadership and prepare youth for the 21st Century.*
- *The SciGirls Seven were the foundation of the work I did with this group. They were high needs group and the SciGirls were a great tool for me to use. I believe this really made a difference in working with them and encouraging them in STEM.*
- *I know the point of this is to revamp these strategies, but I have been using them for 3 year years in my programs and I love them. As a female in science, I wish these had been around when I was in school. I believe they provide a nice balance and allow for the characteristics that historically may have been seen as weak or non sciencey (creativity/craftiness, chattiness/socialization, going in a bunch of different directions at the same time, bonding, etc.) to be their strengths as they participate in STEM activities.*
- *I believe having girls approach the project in their own way is needed up [to a point], however, each lesson or activity always has some parameters that they need to stay within due to having proper materials and space.*
- *Having the students decide how to approach projects in their own way is somewhat challenging. So much of science requires a precise process and certain laboratory skills. The students learned, for example that there was a specific way to hold a tool when doing a chemical experiment that allowed it to be performed correctly with the precision required. Grabbing the tools any way did not allow for precision of measurement, etc. There must be some basic knowledge and instruction to allow them to be successful in their experiments. Once we gave them the basics they were free to follow through with the experiments, but it would have been too frustrating for them to proceed without some basic techniques and procedures.*
- *[Our organization needs] to improve on the mentoring part.*

---

[3] When asked if she had used any of the *SciGirls Seven* to engage girls during Year 1, one educator selected "not sure" and was automatically directed to skip additional survey questions about the strategies. In her follow-up interview, this educator clarified that she had seen the strategies being used in her Year 1 program, but that – because she wasn't the lead educator and had played more of a supportive role – she didn't personally use them during her Year 1 program. However, at the time of the follow-up interview, she was using them in a different program.

1.3 How the strategies were considered in planning and implementation

Figure 7 shows how educators considered the *SciGirls Seven* when planning and implementing their Year 1 *SciGirls CONNECT²* programs.[4] In general, they commented on *how*, *why*, and *when* they considered the strategies.

Figure 7. How the *SciGirls Seven* were considered in planning and implementation

Percentages of educators who shared *how*, *why*, and *when* responses
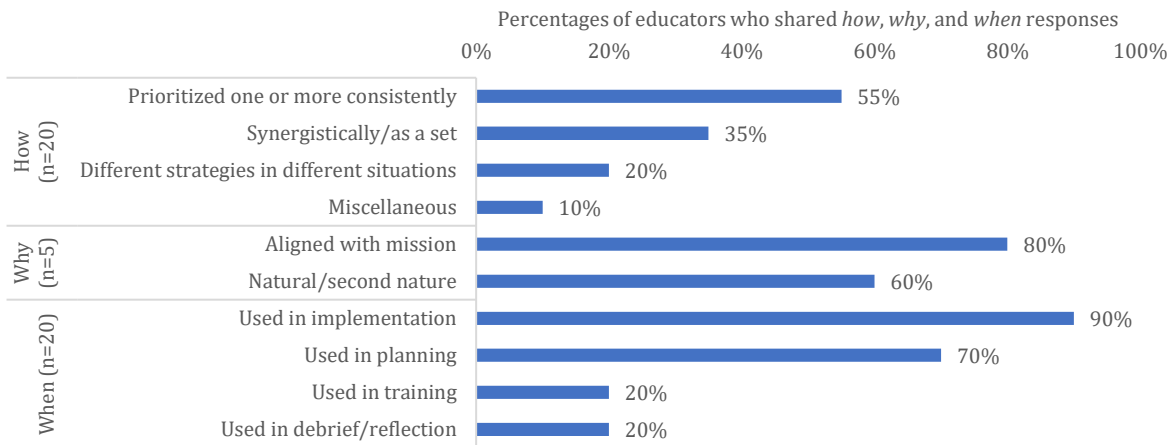
How
Among those who commented on *how* they considered the strategies (n=20), more than half said they prioritized one or more of the strategies consistently (55%). About a third explained that they used the strategies synergistically or as a set (35%), a fifth used different strategies in different situations (20%), and a tenth shared miscellaneous comments (10%).

Why
Among those who commented on *why* they considered the strategies (n=5), most said the strategies were aligned with their organizational mission (80%), while a smaller group described their use as natural or second nature (60%).

When
Among those who commented on *when* they considered the strategies (n=20), most described using them in implementation (90%). A smaller group, but still a majority, described using the strategies in the planning of their Year 1 programs (70%). A fifth each said they used the strategies in training with educators or role models (20%) and/or in debrief or reflection (20%).

Examples of their responses in each case are shared in Table 3 on the following page.

---

[4] The full wording of the survey question follows: Please describe how you considered the *SciGirls Seven* strategies when planning and implementing your *SciGirls CONNECT²* program. ***Please realize there is no right or wrong answer here, we are just trying to better understand how educators tend to think about and practically use the strategies.* Educators were also invited to elaborate in their follow-up interviews.

Table 3. How, why, and when educators considered the *SciGirls Seven*

How (n=20)	Why (n=5)	When (n=20)
Used one or more strategies consistently (55%) • *In creating our program, the way we consider the SciGirls Seven is, right off the bat, we start with #1, there's always a group component …* • *For standards 4 and 6 we implement them into the girls' reflection time. Standard 2 Relevancy we write an overarching goal/take away that we want the girls to learn by the end of the lesson.* • *When I'm planning a program, the easiest one for me is have the hands-on. Always have something engaging, something that is connected to what they're learning in school, something that is relevant, even if they're not learning it in school, I try to make it something that they can connect to.* ***Synergistically/as a set (35%)*** • *We use them throughout all that we do … and I would say that probably programs that are specifically focused on women or girls in STEM are probably in a similar space … because this is what we do, so we don't have to sit down and check boxes … it's good marketing and it's a good way to frame the strategies and to educate others on them, but in practice, they're all intertwined.* • *We use them in all of our programming so they were already well integrated …* • *We use a planning template that has each of the SciGirls Seven outlined. So each lesson is curated with the SciGirls Seven in mind … it's very purposeful when we're planning the lesson, that we hit all of those things.* ***Used different strategies in different situations (20%)*** • *Different strategies with different groups, for sure. With this group, #5 was [implemented] almost all the time.* • *I made sure that each activity we did used at least 4 or more of the strategies. I also made sure that I incorporated different strategies so that I would cover them all.* ***Miscellaneous (10%)*** • *We considered how much they can learn while they partake in investigations, projects and activities and how much they put into it.* • *Many of the SciGirls strategies helped focus the work that would be completed with the girls.*	***Described the strategies as aligned with their organization mission (80%)*** • *Some of the strategies happen not with specific activities, but are part of our culture, like bringing role models in, and encouraging girls to think critically. It's part of how you talk to the kids and ask them questions …* • *We use them throughout all that we do - it's integrated into our way of thinking …* • *I think these strategies are pretty much ingrained in our regular programming …* • *Well, frankly they are the backbone of [our organization] …* ***Use felt natural/like second nature (60%)*** • *… it's just part of our world, we don't have to think about it, it's second nature …* • *I think the later SciGirls Seven are so natural in STEM education, in terms of the feedback given/trusting in their own reasoning … and the role models and mentors are huge in what we do …* • *… we did not specifically consider each strategy as we planned our activities. It was more of an organic, natural flow.*	***Used in implementation (90%)*** • *We considered them vital to the implementation of the program.* • *The SciGirls strategies were easily implemented into [our state's] current Standards of Excellence and Next Generation Standards.* • *We always try to incorporate the SciGirls Seven strategies, either by using SciGirls activities, or incorporating it into our own activities.* • *… it's integrated into … the way we facilitate all programming.* ***Used in planning (70%)*** • *I don't really think about, when I sit down to make a lesson plan for that day, I don't really think oh I'm just going to use these few, it's just whichever ones fall in that category. I make a lesson plan and go okay, how can the strategies be implemented throughout here. And just whatever fits works.* • *We develop our own curriculum when we do so with the strategies in mind. The curriculum planning sheet has all seven strategies listed out and we tailor each lesson to fit the strategies so it's very clear to teachers who are teaching the lessons how to use the strategies during it.* ***Used in training (20%)*** • *This year we had a brand new staff that we needed to train for camp, so we set up a whole series of things we had to train them on* • *[The strategies are] good marketing and it's a good way to frame the strategies and to educate others on them.* • *We shared them with our role models and anyone who assisted with the program …* ***Used in debrief/reflection (20%)*** • *We referenced the strategies … while we debriefed* • *… they are reviewed on a regular basis to make sure the program content remains in place.*

Whether educators shared the strategies with youth
During the follow-up interviews, educators were asked about their use of the strategies with youth, as follows: *When you used the SciGirls Seven during your CONNECT² program, did you ever explicitly talk to or inform your girl participants about the SciGirls Seven strategies? For example, did you tell them about the strategies in general or perhaps label a specific approach you used in your program as a strategy from the SciGirls Seven?* Figure 8 shows whether educators shared the strategies in some way with their Year 1 youth. Among those who answered (20/24), just over half said *yes* (55%) and just under half said *no* (45%). Examples of their comments regarding if and how they told youth about the strategies – and any impacts they thought doing so might have on youth – are in Table 4. As the *yes* responses show, some thought sharing the strategies could increase girls' (and parents') awareness of their learning and growth or might be useful to them beyond the *SciGirls CONNECT²* program. Those who said *no* tended not to elaborate.

Figure 8. Whether educators told youth about the *SciGirls Seven* (n=20)

No, 45% Yes, 55%

Table 4. Whether educators told youth about the *SciGirls Seven* (n=20)

Yes (55%)
- *We start [our program] by going over what each one means … I tried to make it relevant on their level … it's on the very first day, part of our welcome presentation … to have them know what all of them are so that when we see that in the classroom, we can make that connection. I made a kid-friendly version of the SciGirls Seven because originally we were showing just the guide that you guys have online, but it's really geared toward teachers, so maybe something you could work on is having SciGirls Seven that are geared towards the girls, because it's always been difficult to try to re-word it into their level.*
- *I printed out the strategies and handed it out [so they could look it over, take it home, and share it with their parents, which I encouraged] … When I first started the program with them, I introduced it by showing them what the strategies are and what SciGirls is in general. [Before we started they weren't excited that they would have to work in teams] but … by being exposed to the strategies – they weren't going to remember them [off the top of their heads] – but they were like, "Ok, team work is something that has to be done for this to work out," and [then] it kind of becomes something that they do on their own over time.*
- *I feel it had a great impact because, at the end of the program, while discussing their experiences and what they had learned in the program, they were able to share that [collaboration] was one of the strategies that actually helped them.*
- *[Yes, our girls know about the strategies.] Working with the girls, and especially the girls that have been with our program for so long … when we start a new subject or lesson and [tell them we're going to work in groups of 4], they're like, "Strategy 1!" But … the girls in STEM movement doesn't happen in a vacuum. They're going to go back to their classroom [or out into the real world] and they're not going to have a super-safe all-girls environment where they get to be themselves, so we think that arming them with the strategies ahead of time and them really knowing it helps them be better advocates for themselves, like, "I know that I like collaboration … so if I'm in a college course … I know that I would hopefully have the confidence to talk to the professor [and ask if I could do group work" … or choose a course that they would find personally relevant or meaningful over one they don't]. So it gives them more knowledge about themselves, to be better advocates for themselves.*
- *Basically the first meeting was a welcome meeting, so we had the parents and the girls come, we explained [about SciGirls] … and we did list the SciGirls Seven, and we actually had the girls there alternate reading it [out loud, and then we went through exactly what each meant]. So we got them involved in embracing the SciGirls Seven and really understanding what it meant. [As for impact on girls, that's possible] … we don't know each other, they don't know us very well, so I'm sure they read them but I don't know that they thought about them specifically in those terms throughout the program because we did were not referencing them. Now that I'm thinking about it, it would have been helpful to maybe have a giant poster [of the strategies so they could look at it and know that these are the things we're doing, even though we're not specifically talking about them].*
- *I don't think it had a huge impact. I think we did it more because we wanted the parents and the girls to see what our approach was, but I don't necessarily know that they absorbed that. Maybe if we had touched base at each meeting and focused on one and spent some time on it … [which we've talked about doing in subsequent programs] … I think it got them excited, for sure, [but] because we didn't really talk about it more I don't know that it had a huge impact on their experience.*

No (45%)
- *[The strategies] should be part of your planning but the girls should never know they exist.*
- *I don't ever see us explaining to the girls why we would be doing what we're doing, we would just be doing it.*
- *To me they're like the behind-the-scenes strategy of implementing something, and it's like revealing the recipe.*

1.4 Sources and resources that facilitated implementation

Sources consulted when using or planning to use the strategies
Figure 9 shows the sources used by educators when using or planning to use the *SciGirls Seven* in their Year 1 programs. The educators said they used between zero and five sources each, though on average they used two sources. The majority reported that they used the *SciGirls Seven* complete guide (74%) and/or the *SciGirls Seven* two-page reference (61%).[5] Smaller groups described using the *SciGirls Seven* postcard (39%), the gender equity training (22%), their own notes (22%), and/or other resources (4%), specifically "*internet resources.*" About a tenth said they hadn't used any of the *SciGirls Seven* sources (9%).

Figure 9. *Sources consulted when using or planning to use the *SciGirls Seven* (n=23)
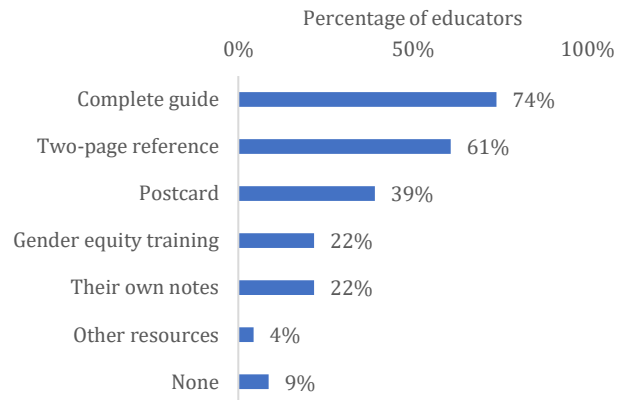
Most useful resources for helping to implement the strategies
Figure 10 shows the resources educators found most useful in helping them implement the *SciGirls Seven* during their programs. While no one resource was named by the majority of the educators, they tended to point to some resources more than others. The largest group pointed to the activities (48%), while smaller groups cited the CONNECT website (22%), the *SciGirls Seven* resources (13%), episodes or clips from episodes (13%), women in STEM videos (4%), the trainings (4%), said none of the resources were especially helpful (4%), or shared miscellaneous feedback (13%).

Figure 10. Resources educators found especially helpful in implementing the *SciGirls Seven* (n=23)
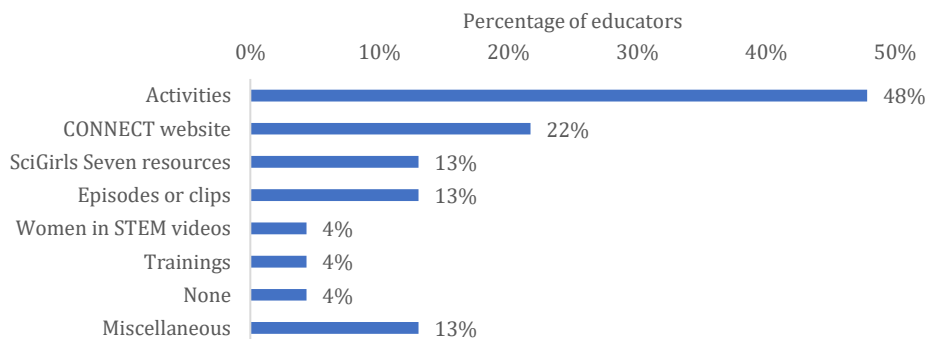
Examples of their responses in each case are shared in Table 5 on the next page.

---

[5] The two-page references is shared in Appendix 1

Table 5. Resources educators found especially helpful in implementing the *SciGirls Seven* (n=23)

Activities (48%)
- *SciGirls Activities. They are designed to easily implement each of the SciGirls Seven strategies.*
- *The SciGirls activities helped implement tremendously with all the SciGirls Seven strategies.*
- *All of the resources that we could use and integrate into existing curriculum, we used. Collaboration activities to help students identify their strengths and the strengths of others.*
- *The SciGirls Seven served as a valuable guide to check ourselves and our delivery of the program. The students were most engaged when we followed those guidelines, particularly with hands-on activities an ad working with mentors.*
- *Though we did not use the exact activities listed on the SciGirls website, I believe they were similar to the activities that the girls did participate in, which helped us to implement the SciGirls Seven.*

CONNECT website (22%)
- *The CONNECT website … really helped me grasp the seven strategies and help implement them because the strategies were relayed in ways that stuck.*
- *SciGirls CONNECT website was especially helpful, spelling out the SciGirls Seven strategies with clear information on SciGirls. Through the website, you can navigate to all areas of the program for information.*
- *I accessed the SciGirls CONNECT website the most to help me implement the SciGirls Seven strategies during the program. This website provided me with the most information and was easy to use. It gave me all the activities as well as videos that went with them which made it easier for me to give an effective lesson on any given SciGirls project we were working on. This website made it easy for me to choose activities that were relevant to the girl's interests and it provided clear directions on how to do all the hands-on activities. When the girls read the description of the activities from the CONNECT website and identified the SciGirls challenge, they became more motivated to achieve the goal each time we met to do the program.*

SciGirls Seven resources (13%)
- *I believe having such a thorough guide, examples and ideas on how to implement the SciGirls Seven do MAKE a huge difference in implementing them.*
- *We used the complete guide as our framework for prepping the instructors before the program began. We referenced it when preparing our activities for each day and found the makeover tool a good check to be sure we were integrating the seven into each day. The post cards with the SciGirls Seven strategies were shared with the girls at the first meeting as well so they knew what to expect. We were able to keep them handy at all times to check back and make sure we were on track. In addition to the mentor guide [and] postcards, which were great, we shared the 2-page reference guide with some of our mentors to give them an overview of the SciGirls program and the strategies and prepare for their interactions with the girls.*

Episodes or clips from episodes (13%)
- *The … SciGirls episodes really helped me grasp the seven strategies and help implement them because the strategies were relayed in ways that stuck.*
- *I love the episodes to help model the SciGirls Seven because it reminds the students that SciGirls all look and sound different, but anyone can do it*

Women in STEM videos (4%)
- *The videos of STEM role models are super useful. Next year we will host role model orientations and work harder to recruit role models.*

Trainings (4%)
- *We've conducted training sessions with our staff on the SciGirls strategies, so I think training the staff and reinforcing these strategies constantly were the most helpful in guaranteeing they were implemented during the program.*

None (4%)
- *We use the strategies in everything we do so not sure any resource in particular was more useful than another. We use them so much we don't really refer to the strategy resources much anymore directly.*

Miscellaneous (13%)
- *This year we implemented journal writing and portfolio development to help students become more reflective of their daily experiences.*
- *I think the idea of team work is most challenging for them. They have had little experience with working in teams, but we continued to encourage communication and team cooperation and saw improvement over the duration of the program.*

1.5 Strategies used most and least often

Figure 11 shows the *SciGirls Seven* strategies educators reported using most and least often in their Year 1 *SciGirls CONNECT²* programs.

Figure 11. *SciGirls Seven* strategies used most and least often (n=23)
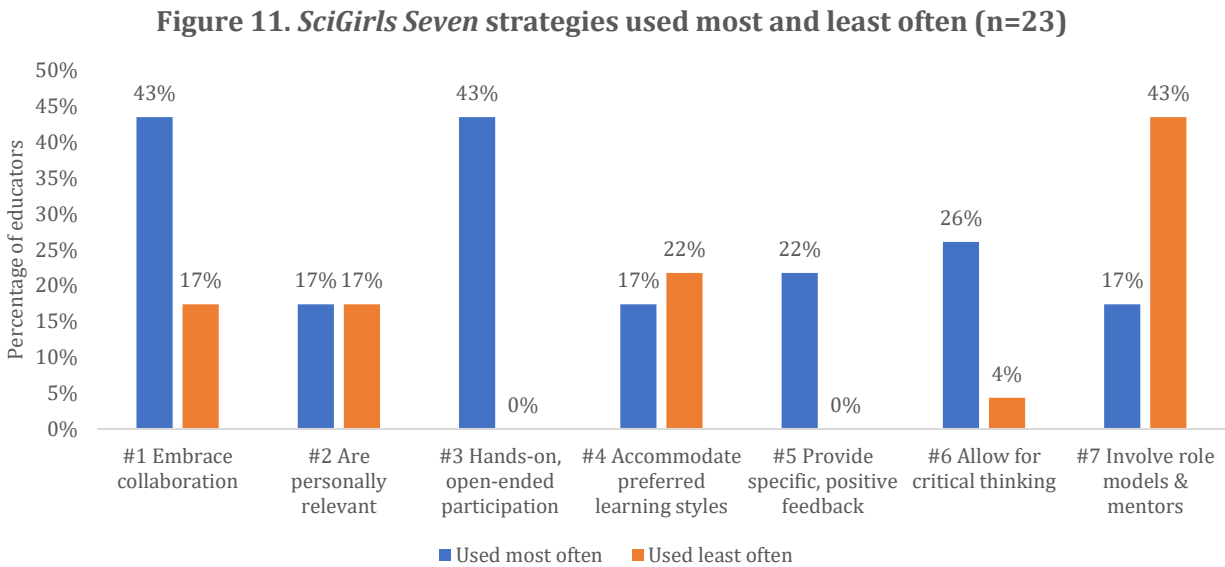
Strategies used most often
When asked to identify the strategies they used most often, no one strategy was mentioned by a majority of educators. The educators listed between one and six strategies each, though on average they listed two strategies. The largest groups pointed to two strategies: #1 Having girls collaborate/work together (43%) and #3 Having girls participate in hands-on, open-ended projects and investigations (43%). Smaller groups (17% - 26%) pointed to each of the five remaining strategies. Though not shown in Figure 11, about a fifth of the educators said all of the strategies were embedded to an equal extent in their programming (22%).

Strategies used least often
When asked to identify the strategies they used least often, here again, no one strategy was mentioned by a majority of educators. The educators listed between one and three strategies each, though on average they listed one strategy. The largest group pointed to strategy #7 Having girls develop relationships with role models or mentors (43%). Smaller groups (0% - 22%) pointed to each of the six remaining strategies. Finally, though not shown in Figure 11, one of the educators declined to answer the question (4%).

Reasons why strategies were used more or less often
The educators were also asked to comment on why they used their selected strategies most and least often. In the case of strategies used most often, some described girls' positive responses to the strategies or cited their ease of use. In terms of strategies used least often, they shared a range of responses. In particular, some who reported using strategy #7 least often noted that they had trouble finding role models or making the most of their visits. Examples of their responses are in Table 6 on the next page.

Table 6. Why educators thought they used their selected *SciGirls Seven* strategies most and least often (n=23)	
Strategies used most often	**Strategies used least often**

Strategies used most often

#1 Embrace collaboration (43%)
- Collaboration was something we wanted to encourage, but it was also necessary due to constraints on time and resources.
- Collaboration - many reasons, saves costs to have girls work together, 2 heads are better than one, have to teach girls how to work together since they will be doing it the rest of their lives, meet new people and learn new perspectives
- Collaboration [because it] gave the more timid girls the confidence they needed

#2 Are personally relevant (17%)
- Meaningful projects that were hands-on activities.
- The ease of applying #1-4 while doing the activities

#3 Hands-on, open-ended participation (43%)
- We left things open ended to allow their creativity to come through.
- Hands-on activities are essential to keep them engaged.
- The girls did enjoy hands on activities because it made them think critically while doing investigations.

#4 Accommodate preferred learning styles (17%)
- Most often used was #4; we encouraged girls to see that there isn't just 1 way to accomplish something, and they were able to be unique & creative, on their own terms to achieve the goal, or complete activities.
- 1-6 seriously

#5 Provide specific, positive feedback (22%)
- ... positive reinforcement because I can see the change in the girls within a day and how positive reinforcement affects them.
- Strategy 5 - specific feedback on things they can control helps to bolster confidence on things kids can control since they can't control most of the world.

#6 Allow for critical thinking (26%)
- We wanted the girls to be able to recognize that they could discover some understandings on their own.
- Strategy 6 - kids are not pushed in school to do this due to time constraints. Out of school opportunities allow for time flexibility. Kids will often wait to hear the correct answer from a teacher and are afraid to put themselves out there by thinking critically

#7 Involve role models & mentors (17%)
- Role models- many reasons again, SO important for girls to see women in the space succeeding, employee engagement with companies that are sponsoring our program, work force development, so we can answer the girls when they ask "why will I ever need to learn this!"
- ... developing relationships with mentors.

All embedded to an equal extent (22%)
- Honestly, we used most of the strategies pretty evenly throughout our program. They all go hand-in-hand ...

Strategies used least often

#1 Embrace collaboration (17%)
- Strategy 1, collaboration and communication. I think we use the collaboration a lot through partnering and small group work, but I think the communication is something that can take more time to fully develop than we have in the one week.
- Strategy 1- because we do this so often anyway. It is important but happens organically.

#2 Are personally relevant (17%)
- Finding projects they find personally relatable. The girls didn't have a lot of STEM exposure, so it felt like every project was a project of disinterest UNTIL they tried it and realized they like it. It was also hard to do projects the students wanted due to budgeting and time constraints. A lot of the Sci Girls projects were greater than 2 hours, which is a major challenge when operating under the restraints of the school system.
- Real world connection - we operate in 2 different states and [girls in one state] maybe very interested [in a topic that girls in the other state aren't] ... we don't know the girls ahead of time to know what interests and motivates them when we are building the curriculum so we have to guess.

#4 Accommodate preferred learning styles (22%)
- Having students approach everything their own way. I believe this can be done when students have some experience in working in STEM. These students needed initial guidance to learn about what is required in scientific, technical or engineering process. Many of them did not know where to begin without guidance.
- Personal learning styles - we can plan in our curriculum to have a variety of work products throughout the week but to offer different work products option within one lesson is hard from planning, budgeting and supply system point of view. We don't know the girls ahead of time to know what their preferred learning style is.
- We find [this strategy] difficult to implement due to lesson/ activities procedures, materials and time.

#6 Allow for critical thinking (4%)
- Thinking critically -- some activities needed more science integration

#7 Involve role models & mentors (43%)
- We have role models at each meeting and considered ourselves to also be role models but it wasn't the main focus of the day ... more a support and inspiration.
- I would have liked to have more role models and mentors involved. We did have several special guests, and the educators participating in the camp were good role models, but I would have liked to bring in more female scientists.
- Though we did have several role models for the girls to interact with, I wish we had incorporated the role models into activities that they could participate in with the girls.
- 7-- it is hard where we live, but as I said, I am going to work on getting local people
- Having the consistent role models.

1.6 Whether educators found strategies redundant or best in combination

Educators who completed the follow-up interview (20/24) were asked if, based on their Year 1 programs, they found any of the *SciGirls Seven* redundant or thought there were any that were best used in combination.

Whether educators thought any strategies were redundant
Figure 12 shows the strategies that educators found redundant. Most educators said they did not find any of the strategies redundant (90%). One each said they found strategies #1 and #4 redundant (5% each). Their responses are shared below the chart.

Figure 12. Strategies educators found redundant (n=20)
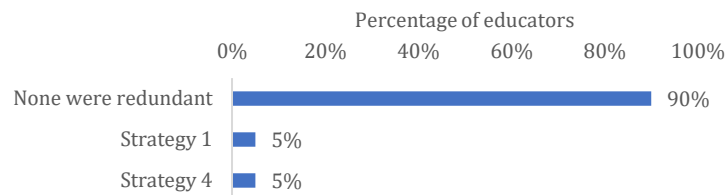
Percentage of educators

- *I think the collaboration piece is a little bit redundant, but it's important. It's so hard because I feel like there's a spectrum of STEM educators. Like, when I train other educators, they don't know it, but for me I'm like, "Oh, duh, collaboration" … So I feel like #1 is a little bit of a duh strategy, at least for me. I know girls benefit from collaboration. I feel like if they are going to have it, it needs to go a little bit deeper, like a more real-world sense of collaboration, what does collaboration look like in a work place and then how can we bring that to learning opportunities.*
- *I felt like 4 and 6 were very close … Actually, if we were going to get rid of one, I think I said #4, because if you are going to approach a project, you're going to do it in your own way, so I feel like it's intuitive.*

Whether educators thought any strategies were best in combination
Figure 13 shows the strategies that educators thought were best used in combination. No one combination was mentioned by the majority of educators who answered this question and nearly one-third declined to identify a combination (30%). Among those who did suggest a combination, nearly one-third pointed to strategies #2 through #4, with most in this group specifically suggesting combining strategies #2 and #4 (30%). One-quarter thought strategies #5 and #6 could be combined (25%), and smaller groups suggested combining #1 and #3 (15%), or shared miscellaneous suggestions (20%). Examples of their responses are in Table 7 on the following page.

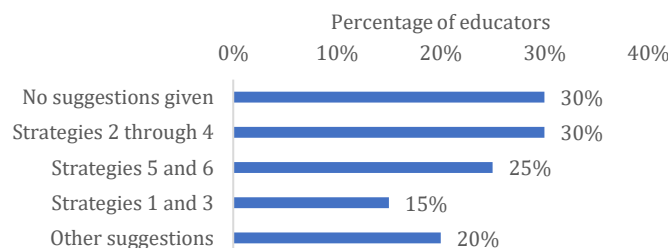**Figure 13. Strategies best used in combination (n=20)**

Percentage of educators

Table 7. Strategies educators thought were best used in combination (n=20)

Strategies #2 through #4 (30%)
- *Sometimes they're a little related, perhaps, like with 2, 3 and 4 … sometimes that seems to me that they're all kind of intertwined and very similar …*
- *Two strategies talked about motivating, but they talked about motivating in different ways – #2 and #4. They're similar in that they're about personal motivation*
- *I feel like I combine the 2nd and 4th one because … I think of those in the same vein, but I do think they're separate strategies, and it makes sense that they are – just this idea that there's a bigger purpose, and with a bigger purpose they're able to apply it in their own way, and approach it in the way they want to.*
- *I do feel like #2 and #4 seem similar to me … I didn't see much difference in them. I feel like they kind of work together.*
- *It felt like a couple of them could have been merged … personally relevant and preferred learning styles … those are the two that I felt … kind of go hand-in-hand, because you allow the students to express their learning styles, and that leads to the activities or the experiences being personally relevant.*

Strategies #5 and #6 (25%)
- *#5 & #6 … I think sometimes can be the same thing, because it may be … how you give feedback is what makes girls think critically as well, but again, they are different too.*
- *#5 and #6 – we critiqued each other's' work as a group, and I let the girls critique me too, and we were giving positive feedback at the same time*

Strategies #1 and #3 (15%)
- *#1 and … I think #3. I think those could be combined. Because when you're doing hands-on, open-ended projects, you are collaborating by nature.*
- *If they did hands-on things … [I would also give the positive feedback] … and they're already working in groups, so all of those things were together most of the time.*

Miscellaneous (20%)
- *I feel like maybe you could do the personally relevant projects and open-ended projects in the same strategy, because I also think they go hand-in-hand … Maybe I'm saying that because I feel the most comfortable with those though.*
- *There's a couple of them [that are hard to measure if there's been a change in behavior,] so I guess the ones that are more behavioral … positive feedback … it's hard to measure what they're gaining from the collaboration … and maybe the learning styles. Behavior is so hard to measure, right?*
- *I think the positive feedback, the working in groups, the critical thinking, those were things that all combined.*
- *Definitely the teamwork and allowing them to pick their own tasks. I think that that worked really well together because … sometimes we had projects where they were working in teams [and half of the class worked on one aspect of the project while the other half worked on the other aspect, and then we would have them present on what they did]. It was kind of based off of interest, so that kept each side engaged, and because we had two teachers, we were able to do that … [And another thing I liked about this was], so maybe one group wasn't so interested in a certain part of the project, but they were still getting educated on it, so they got to do the part that they preferred, but everybody learned. I think that presentation aspect of it helped the girls gain a little confidence, there was a little sense of pride from the work that they had done. I think that's really important in learning.*

1.7 Examples of how the strategies were used in Year 1

The educators were invited to share how they used each strategy in their Year 1 programs. The majority of educators were able to provide an example of how they used each strategy (70%). Table 8 shares examples of the unique ways in which they used each strategy.

Table 8. Examples of how the educators used the strategies in Year 1 (n=23)

#1 Embrace collaboration
- *They worked in groups throughout the entire camp and rotated roles in groups*
- *Several of the experiments we did were designed to be done in a group so they could ... practice communicating with each other.*
- *We do group work for all of our activities and experiments. This works extremely well. We did it during a rocket ship build which was important because there was no one 1 person doing it alone would be able to get it done on time so the girls had to collaborate and take on roles to complete the project on time just like they would have to do at work!*

#2 Are personally relevant
- *We do themed weeks that the girls choose to sign up for so they are naturally interested in that week's theme.*
- *... the girls decided on a topic that they wanted to do a project on. They worked on this project for the entirety of the program.*
- *We worked on a project regarding airplanes and how we could make them more fuel efficient by changing the design. We thought it would be relevant because of the environmental focus and also travel.*

#3 Hands-on, open-ended participation
- *All activities were hands-on or open ended. It was also my preferred choice in activities to have them participate it because they retained more.*
- *Almost all of the projects we did were hands-on. We made sure that we didn't box them into directions and so when girls would ask, "should it be like this?" we would respond, "that's up to you and your interpretation."*
- *We used hands-on activities in every session. In fact, we spent the majority of the time doing hands-on activities. These students were coming out of a full day of school and we were trying to make this experience different from what they did all day.*

#4 Accommodate preferred learning styles
- *When the girls did the Deep Sea Diver activity, they were really encouraged to approach the project any way they felt would work. No two projects were the same.*
- *We had an open table of extra supplies all day and encouraged students to use the materials from other projects on their current projects to stimulate creativity.*
- *... [they kept] journals throughout the program. This was their tool to use as they wanted. They decorated them on the first day to make them their own unique journals and they had them at every meeting. They could take notes, collect data, draw pictures, write notes/thoughts. The idea was for them to record their experience in SciGirls in whatever way was meaningful for them.*

#5 Provide specific, positive feedback
- *Our teachers know about growth mindset and are trained on what say in terms of highlighting effort over innate smart-ness.*
- *We tried to do this regularly throughout the program. At the end of each day/activity we gave opportunities for girls to share their thoughts and reasoning and would give positive feedback. We also were engaged with them constantly regardless of what we were doing and were always trying to acknowledge girls for great questions, good tries (even if it didn't work how they planned), for asking and answering questions ... it was a constant.*
- *In addition to giving positive feedback during lessons, we also had a SciGirls Shout-Out kudos jar, where the girls (and we) could write words of encouragement and praise.*

#6 Allow for critical thinking
- *I feel we encouraged the girls to think critically on a daily basis by allowing them to come to answers on their own without us giving them too much information.*
- *During plant collecting, they often asked "what plant is this", but I would ask them what they thought and why, and asked how they could figure it out.*
- *Girls had to think critically while doing all activities. One activity that really required critical thinking was the clouds clues activity. They had to really pay attention to the clouds and compare and contrast what kind of cloud it was considered.*

#7 Involve role models & mentors
- *We had several layers of role models. We had many who spoke with the girls about their careers, some who were introduced through short snippet videos and of course their instructors.*
- *One of our role models actually works at the science center and they would see her come in and out and they would always stop her and ask her questions and show her their activity for the day or share the information they learned with her.*
- *... we did try to find mentors of Hispanic heritage, so the Latina students could identify with them. Not all were Latina, but it was enough to show them that there were successful Latina women who looked like them in professional STEM jobs. They were excited about all the mentors but this connection of ethnicity was important.*

1.8 Whether and how the strategies enhanced envisioned STEM outcomes

Educators were asked whether, during their Year 1 programs, they saw the *SciGirls Seven* strategies enhance the specific STEM outcomes TPT envisioned in the *SciGirls Seven* complete guide, and, if so, to explain how or, if not, to explain why not. For reference, the *SciGirls Seven* are summarized in Image 3.

Figure 14 shows whether educators indicated they saw the outcome enhanced, with their responses categorized as *yes, yes with caveats, maybe,* and *no.*[6] Among the educators who shared a response, most (between 84% to 100%) said *yes* or *yes with caveats* in regard to each strategy.

Image 3. The *SciGirls Seven* ([courtesy of TPT](#))

Figure 14. Whether educators saw the *SciGirls Seven* enhance STEM outcomes
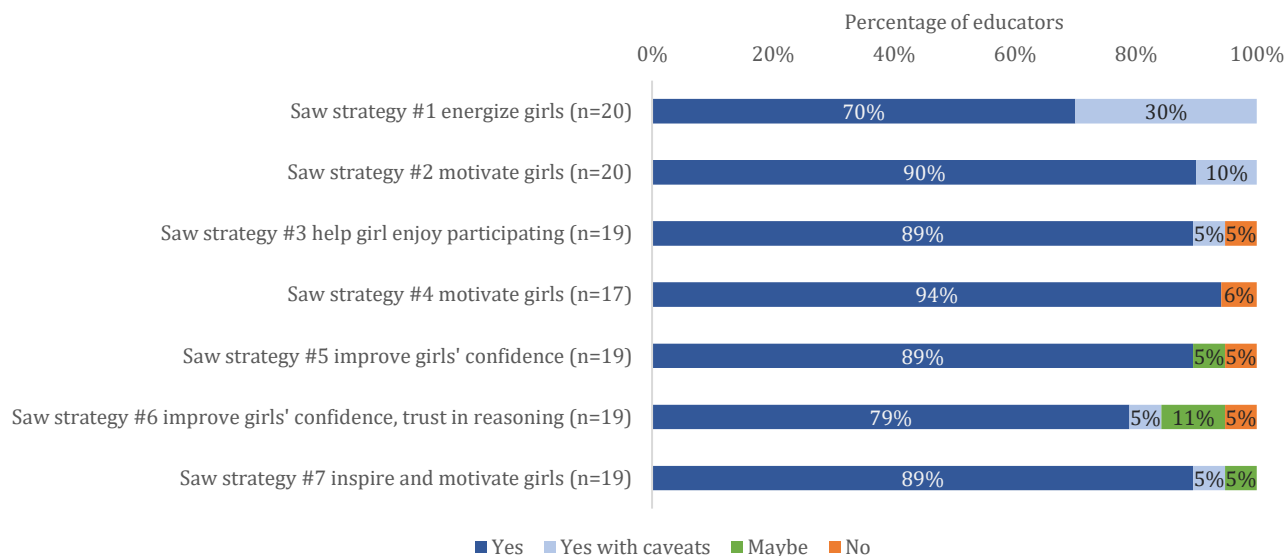
When asked about the envisioned impacts of each strategy, educators shared the following feedback:

- The majority said they saw strategy #1 energize girls (70%), while about a third said *yes, with caveats* (30%).
- Most said they saw strategy #2 motivate girls (90%), while few said *yes, with caveats* (10%).
- Most said they saw strategy #3 help girls enjoy participating (89%), while few said *yes, with caveats* (5%) or *no* (5%).
- Most said they saw strategy #4 motivate girls (94%), while one said *no* (6%).

---

[6] In considering each strategy, some educators left the question blank; these responses are not included in Figure 13.

- Most said they saw strategy #5 improve girls' confidence (89%), while one said *maybe* (5%), and one said *no* (5%).
- Most said they saw strategy #6 improve girls' confidence and trust in their own reasoning (79%), while one said *yes, with caveats* (5%), a few said *maybe* (11%), and one said *no* (5%).
- Finally, most said they saw strategy #7 inspire and motivate girls (89%), while one said *yes, with caveats* (5%) and another said *maybe* (5%).

Examples of their comments in each case are shared in Table 9, below and on the following two pages.

Table 9. Whether educators saw the *SciGirls Seven* enhance STEM outcomes in their Year 1 programs

Did they see strategy #1 energize girls? (n=20)

Yes (70%)
- *Yes - they love working in teams and working with each other to come up with solutions*
- *The girls enjoyed working together and there was a sense of cooperation which energized the girls.*
- *Yes, it definitely energized the girls! They took a lot of pride in their job for the rocket and how it fit the overall plan and build of their product.*
- *It did energize them because they were able to share ideas together and collaborate on the activity to make it better after receiving feedback or before testing out their project.*

Yes, with caveats (30%)
- *I think it worked when they liked their group or partner. It was difficult for the few times that girls didn't want to work together. It was a good opportunity for them to work on collaboration and learn to communicate fairly with others, but they weren't particularly pleased or energized about it, and because we only work with the girls for one week, it can be challenging, since they don't have the time to really develop relationships with all the other girls in camp.*
- *Half the time they enjoyed it. [The other half of the time] they either did not like their partner or did communicate fairly. This was one drawback which bred behavior issues that were not completely addressed by partnering staff.*
- *In most cases, yes! The girls who had similar interests joined groups and were able to share ideas, work through questions and come up with solutions. We did have to step in at times because they got so excited that they sometimes got off topic (as is expected.) We did a few students that were not fans of this strategy. They struggled to work with others in their group and come to a consensus when they had disagreements. We were able to facilitate most of the time, but it was interesting to see how even though we think this is the best thing ever, it was not the case for some of the more introverted and independent students. It was still a good experience for them though.*
- *They were hesitant at first. Most adjusted to this approach and did well in the end. A couple of the very shy girls had more trouble and those with little English language also struggled a bit, though their friends were quick to translate when necessary. We incorporated Spanish into the group activity when possible. They became a cohesive group by the end of the program and were so excited about STEM that they want to continue the SciKids program.*

Did they see strategy #2 motivate girls? (n=20)

Yes (90%)
- *Having them work on projects that were relevant to them made them more interested and motivated them to keep trying until they made a successful project.*
- *Yes, some girls were motivated to conduct advanced research for their topics.*
- *It did motivate their creativity.*

Yes, with caveats (10%)
- *There was one group that have difficulty with this as they could not agree on what was relevant and meaningful (interesting) to them. They compromised and still did a great project, but they did not seem as enthused as the other groups. If we had more staffing, we would have let them work on aspects of the project more independently and then share results, but we worked within the parameters we had.*
- *It was okay. Some of the girls had never been on an airplane so it was a little far removed from them. It wasn't an issue that they face every single day so some of them didn't understand why it was that important.*

Table 9 Continued.

Did they see strategy #3 help girls enjoy participating? (n=19)

Yes (89%)
- *Yes, I saw girls enjoy finding their own way to complete the test. Each group did it differently.*
- *Yes - that was their favorite part of the camp - doing activities.*
- *Yes. They came back and wanted to work on projects at non-designated times. They took things home to work on between meetings.*

Yes, with caveats (5%)
- *Sometimes the girls would get a little frustrated because they wanted an answer but once they realized the freedom it gave them, that changed.*

No (5%)
- *It did frustrate some of the students who wanted a prescribed lesson.*

Did they see strategy #4 motivate girls? (n=17)

Yes (94%)
- *Definitely! The girls were so excited about their projects and it was very inspiring to watch them approach their question in different ways, each girl contributing in the way that highlighted her own strengths.*
- *Yes - they were excited to try to use their skills and create something meaningful*
- *With them approaching the activity in their own way it made them feel more confident in themselves which motivated them*
- *They were very excited about the project and dove in with enthusiasm. Structural success [of our gingerbread house activity] varied but process was more important than product in this case, and they all found it a rewarding experience.*

No (6%)
- *Not really since this is kind of an expectation of the group.*

Did they see strategy #5 improve girls' confidence? (n=19)

Yes (89%)
- *I saw this improve their performance in the way that they continued working on the project and seemed more engaged to continue. Perhaps that can be seen as confidence as well, because they seemed more determined in their strategies.*
- *It did increase their confidence and performance because it allowed them to see exactly how their actions were impacting the projects*
- *YES - students really fed off this strategy. But it took a ton of energy with 20 students and not enough other staff offering the same support. This strategy is super important!*
- *The girls loved this idea and would rush to the bathroom (where the kudos jar lived) to write kind messages for their peers. We all enjoyed the public forum of reading these kudos at the end of the day before the girls' parents picked them up.*
- *Yes. They shined and increasingly supported one another as time went on.*
- *This absolutely improved their confidence and performance. By giving positive feedback, it made them know that you were actually paying attention to them and their creation. It also made them work harder and think more critically knowing that I was going to give them feedback.*

Maybe (5%)
- *I saw improvements in confidence and performance, but I don't think I can attribute them specifically to how feedback was given*

No (5%)
- *We didn't really see a difference … just because they were working hard, didn't make it easier and they still got frustrated.*

Did they see strategy #6 improve girls' confidence and trust in their own reasoning? (n=19)

Yes (79%)
- *Yes - they felt empowered to figure things out and we could see them using these same techniques with their families when they challenged them to the dough creature activity*
- *I noticed when we were working on one of the projects, one of the girls turned to another and asked her what she thought of her project, the other told her it looked great and asked her to explain what she did, just the other classmate asking for an explanation made her light up and she just started explaining every detail.*
- *We have noticed the girls trust in their reasoning go up but we have also noticed that their ability to explain what they have learned with confidence goes up. By the end of the week for the parent celebrations the girls are able to us scientific language to explain what they have learned in each activity.*
- *I would say yes, though I believe this goes hand in hand with strategy 5. Many of them were hesitant to make decisions when there wasn't an apparent answer, but with encouragement and positive feedback, along with an understanding that it is okay to make mistakes and learn, they did seem to gain confidence and as the program progressed, there were more willing to think critically and creatively to find solutions and come up with ideas.*

Table 9 Continued.

Yes, with caveats (5%)
- *Yes - but they did not like to be pushed to do so. but once we got our groove it was all good*

Maybe (11%)
- *Some of the girls take it seriously and some of them didn't.*
- *I think so. They sometimes got frustrated.*

No (5%)
- *I don't think I would specifically attribute girls' improvements in this area to this specifically*

Did they see strategy #7 inspire and motivate girls? (n=19)

Yes (89%)
- *This truly made a difference ... it was inspiring for the girls to see women in real life talk about their career in the science field.*
- *This strategy definitely helped to motivate the girls to see STEM in a different light. Questions that related career to life experiences and the expectations for the girls were free flowing.*
- *The girls all showed great confidence that they could do whatever they want to do in STEM. I believe the mentors really convinced them it was possible.*
- *The girls get the most out of the mentors we have come in and speak and work with the girls. They are able to see what they are learning in class and how it applies to a future profession. They are always very interested in what the women do and it opens up their options of working in a field they enjoy.*
- *Yes, because science is such a broad field, certain role models appealed to certain girls and inspired them to want to pursue their passion; the mentors gave the girls guidance and motivation on how to do so.*
- *Absolutely! One of our girls' parents said that after a chat with our guest geologist, she decided that she would become a marine geologist because she learned so much from the mentor.*
- *Yes. The girls were excited each meeting to meet the role models and ask them questions. I took a peek at the post surveys just to see what their feedback was and many of them mentioned pursuing careers in fields that the role models shared with them. We also got some great feedback from parents on our group Facebook page after the program [such as]: "Thank you ladies! This was such a great opportunity for these girls. TY for being amazing role models and powerful, strong, intelligent women!" and "Thank you so much for inspiring the girls each month. Your enthusiasm and passion for what you do was definitely noticed! My daughter has an even deeper passion to continue following her dream of working as a scientist with amazing ladies like you. Thank you for everything you do. I couldn't ask for better role models."*

Yes, with caveats (5%)
- *A few of the girls tried really hard even though some parts of the [activity they did with a role model] did not work right.*

Maybe (5%)
- *More often than not.*

1.9 Whether and how the strategies impacted girls' STEM identity

Whether impacts were observed

Educators were asked if, as a result of using the strategies in their Year 1 programs, they observed girls' STEM identity impacted in some way. To help frame their responses, they were given the definition of STEM identity developed by the research team and used by the *SciGirls CONNECT²* project: *STEM identity integrates confidence, interest and motivation around STEM, and ultimately affects choices, behaviors, persistence and perceptions of STEM careers and STEM professionals.*[7] Figure 15 shows that most educators said *yes* (87%), while just over a tenth said the question was *not applicable*, for unknown reasons (13%). Those who said *yes* were then asked two follow-up questions, detailed below.

Figure 15. Whether educators observed an impact on girls' STEM identity (n=23)

Not applicable, 13%

Yes, 87%
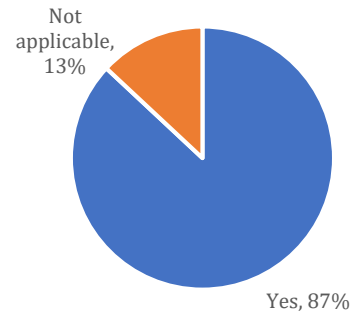
Types of impacts observed

Educators who said they had observed girls' STEM identity impacted in some way were then asked what impacts they had observed. Figure 16 shows the impact of using the *SciGirls Seven* on girls' STEM identity, as observed by educators. In general, their responses focused on the individual components of STEM identity, per the definition provided, rather than the integration of the components. More than half said they saw an increase in girls' confidence (60%) and/or an increased engagement with or interest in STEM (60%). Smaller groups observed an increased interest in STEM careers/professionals (40%) or shared miscellaneous responses (15%). Examples of their comments are in Table 10 on the following page.

Figure 16. Impact of using *SciGirls Seven* on girls' STEM identity, as observed by educators (n=20)

Percentage of educators

Increased confidence	60%
Increased engagment with or interest in STEM	60%
Increased interest in STEM careers/professionals	40%
Miscellaneous	15%

---
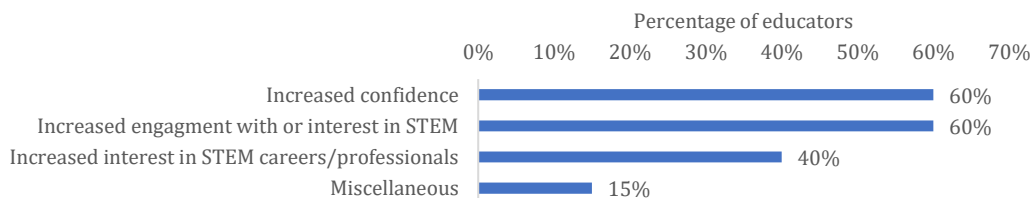
[7] The full question asked about STEM identity follows to show that the educators were given the definition of STEM identity used by the *SciGirls CONNECT²* project: As a result of using the *SciGirls Seven* strategies in your *SciGirls CONNECT²* program, did you observe girls' STEM identity impacted in some way? As noted earlier, STEM identity integrates confidence, interest and motivation around STEM, and ultimately affects choices, behaviors, persistence, and perceptions of STEM careers and STEM professionals.

Table 10. Impacts on girls' STEM identity observed by educators (n=20)

Increased confidence (60%)
- *Increased comfort presenting in front of others.*
- *The students' STEM identity was positively impacted. They developed confidence ...*
- *I noticed the girls' confidence rise ...*
- *The girls speak more confidently about their reasoning and findings to adults and teachers. The confidently share with their favorite part of the week was and what they will be when they grow up which is often a job that a role model have.*
- *Most of them exuded confidence in what they were doing by the time we had completed the program*

Increased engagement with or interest in STEM (60%)
- *At the end of camp, I had a few girls express a deeper interest in biology and botany, and they all expressed interest in science. They developed ... interest and motivation around STEM subjects ...*
- *Over time, the girls became much more interested in participating in the various activities. the girls became more interested in STEM in general, and wanted to do more projects, more often.*
- *Many of the girls were already asking about our next SciGirls program.*
- *At the end of this entire SciGirls program, I've seen a lot of them become a lot more interested or eager to do science or STEM. Every week they would ask, "Are we going to do SciGirls today?" ... for me, that shows me that ... their identity in themselves became more clear and they know what they want to do, they know what they want to achieve, and they just want to do projects that are part of their interest, and that's SciGirls!*

Increased interest in STEM careers/professionals (40%)
- *The girls outlook on STEM careers and how they actually want them now.*
- *They ... realized that they could be scientists.*
- *I noticed ... their knowledge of a variety of career options in STEAM.*
- *The girls learned about careers that included STEM that they previously thought had nothing to do with science.*
- *They confidently share ... what they will be when they grow up which is often a job that a role model have.*
- *I truly believe that many of these girls will go on to pursue careers in STEM. Some of them were already on the path, but many were unsure what it even really meant (as evidenced by the first videos). I think they gained a greater understanding of marine careers and the importance of conserving natural resources which impact their choices and behaviors in the future.*

Miscellaneous (15%)
- *The girls seemed to get closer by the end of the semester.*
- *Parents state that students are more attentive in their core classes and eager to find that hands on opportunities in the content in which they are learning. Students began to develop their own strategies through are and music integration to help them understand certain concepts.*

Strategies found most important in facilitating STEM identity impacts

Figure 17 shows the strategies educators found most important in facilitating the STEM identity impacts detailed on the previous page. As a group, between one-quarter and two-thirds of the educators pointed to each of the individual strategies as having been most important in facilitating the impacts they had identified.

Figure 17. *SciGirls Seven* strategies educators found most important in facilitating STEM identity impacts (n=20)

Percentage of educators

Strategy	Percentage
#1 Embrace collaboration	40%
#2 Are personally relevant	25%
#3 Hands-on, open-ended participation	45%
#4 Accommodate preferred learning styles	40%
#5 Provide specific, positive feedback	35%
#6 Allow for critical thinking	30%
#7 Involve role models & mentors	65%
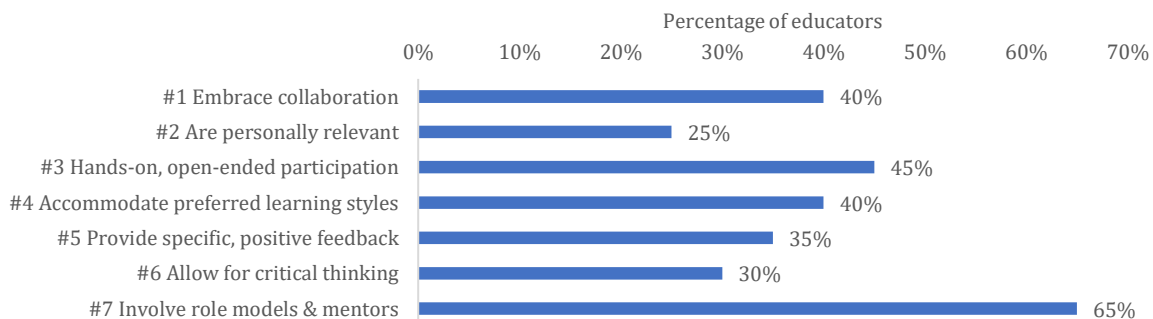
Specifically, in order of descending frequency:

- Two-thirds of the educators pointed to strategy #7 Having girls develop relationships with role models or mentors (65%).
- Around two-fifths each pointed to strategies #3 Having girls participate in hands-on, open-ended projects and investigations (45%), #1 Having girls collaborate/work together (40%), and #4 Having girls approach projects in their own way (40%).
- About a third each pointed to strategies #5 Giving girls specific, positive feedback on their effort, strategies, and/or behaviors (35%) and #6 Encouraging girls to think critically (30%).
- One-quarter pointed to strategy #2 Having girls work on a project designed to be personally relevant and meaningful to them (25%).
- In addition, some educators went on to explain that they found all seven strategies *most important* in this regard (15%) and a few shared miscellaneous feedback unrelated to the question.

Part 2. Suggestions for the *SciGirls Seven* strategies

Educators were invited to share revisions and suggestions to the *SciGirls Seven* in their formative survey and follow-up interview. They were also given an opportunity to "think outside the box" and share additional recommendations in an effort to leave open the possibility of changes to the *SciGirls Seven* beyond updates or modifications. All of the educators' proposed revisions, additions, and recommendations are shared below.

2.1 Proposed revisions

When invited to share proposed revisions, educators commented on five topics addressed in the current *SciGirls Seven*: relevance (including cultural relevance), collaboration, role models, positive feedback, and preferred learning styles. Their comments are in Table 11, below and on the following page.

Table 11. Proposed revisions (N=24)

Relevance (including cultural relevance)

- *I don't think you need to add a cultural relevance strategy, but it could be incorporated into the role model and activity side of things … it could be part of the "how do you implement this strategy" side of things … so if the culturally relevant piece is important, it's embedded throughout, it's not a stand-alone separate thing where you would check the box and say "ok we have a culturally relevant role model, we're done," because that's not … really incorporating that important piece all the way throughout … I think it's also helping educators understand how to adapt, modify, be creative with their activities – even SciGirls activities – to make it relevant to the community that they live in.*
- *We offered materials in Spanish for those who may need them (although I don't think any used them). Should we have had Spanish-speaking participants or families, this is an important way to make sure they are included. [This strategy is based on] research … nothing really different than what would be in the Latina SciGirls side of things or the materials Alicia presents at the SciGirls trainings. [It should be incorporated into the SciGirls Seven because] something around cultural relevance would be good to include as a good reminder of how important this is to engage students.*
- *The only thing, which I mentioned earlier, it relates to #2, making it personally relevant as well as culturally relevant … It's somewhat mentioned in the SciGirls Seven … but the culturally relevant, in addition to the personally relevant, because a lot of the groups we work with … [are from neighborhoods where they're not exposed to any sort of science in this way], so somehow incorporating what's going on in their community, whatever that may be, would be a huge step in sort of making them feel part of something that can actually happen.*
- *Relevance- I feel that the girls need to be excited about a topic but they don't necessarily need to find it relevant in the beginning. I believe it expands their knowledge of what they think of a specific topic.*
- *Engage students in critical reflection about their own lives and societies. How can they take what they learned and apply it to their own life/society/neighborhood … Maybe having one more piece that wraps it up would be more of a complete experience for the girls and would have more of a lasting impression on them … working with this last group, I would have loved to have done more reflection. Doing some of the activities that we did, and then scaling that up into a reflection … Getting them to think about how they can take activities that they've done and apply it to their very small neighborhood and then scale it out from there.*
- *I noticed that showing interest in the girls and what they're learning, like asking questions … I think it goes to the SciGirls Seven strategy of relevance, having projects that are relevant and meaningful to them, but I think part of that is talking to girls, like, 'What are they interested in? Why did you sign up for this program, and what do you want to learn?' I think forming that relationship is also part of that role model/mentorship strategy as well.*
- *I think the personally relevant strategy could be amended to general subjects that girls find interesting. I think that it's hard to know what each of the girls' specific interests are but what do girls interests trend to be - environment, life science, etc.? Help an educator out so that they have a starting place instead of feeling overwhelmed on not knowing what exactly the students are interested in … So, what are some trends overall that you can kind of have as, "Well, we know girls are really interested in helping sick kids," let's find a pediatric oncologist … like, trends over time would be really helpful … And I am also in the camp of "girls don't know what they don't know," so if they've never been exposed to engineering, that doesn't mean that they don't like it, they just have never had it. So still exposing them to a breadth of subjects is important, but … I'm always interested in how SciGirls chooses their videos and activities, and how that happened … I have a hard time believing they [decided] to do a full-length episode based on something that no one cares about … obviously they have a system, so how do educators tap into that system too?*

Table 11 Continued.

Collaboration
- *I think something our educators maybe struggled with was how to deal with interpersonal relationships with girls, because I think there was a lot of … not arguing … but a lot of things that ended up being not as constructive as they could have been, that ended up leaving some girls feeling worse, like their ideas weren't being appreciated by the other girls as much. With kids, you see that as a normal part of their social development, how they banter with each other, but I think it would be great to have a way of facilitating that with girls that maybe helps to make that process more constructive, like maybe specifically set some ground rules for discussion that make it more fair, so the girls feel like they're getting their voice heard more, and then the other girls [learn] how to engage in dialogue without feeling like you're arguing or getting really personally emotional, like keeping an open-mind and seeing each other's perspective … so, how to engage in constructive dialogue …*
- *It might be good to add some social values like respect to which all should aspire. That would be respect toward instructors and mentors, respect for the materials and facilities which are supplied, and respect for each other as well as self-respect. We had to stress this often. Girls need to value themselves to develop the confidence needed to pursue professional goals. There are stories about how many girls have gone into computer work and some other fields but have not stayed in those field because of the harassment and disrespect toward them. Somehow we need to prepare girls for this while at the same time teaching respect to both boys and girls so we have better work environments.*
- *More non-competitive, more working together than competitive … I see that they can get competitive, but they seem to work better when they're just helping each other.*

Role models
- *We tried to get female role models when possible, but we had the opportunity to have a couple of outstanding male mentors as well. I did have parent feedback that they wanted the program to have both male and female participants and role models because that reflected the real word better than an all-girl program.*
- *Continued focus on role models - especially ones that look like the girls makes a huge difference. Having a diverse pool of role models is so important.*

Positive feedback
- *And then having us [pay attention to what they've done] … and giving them [positive feedback] really played a part in them making wanting to do SciGirls again, because it showed them that we cared and that we were really taking the time to see what they created, how they created it, and that we supported them.*
- *I do tell them that there's nothing men can do that they cannot achieve. And I think that was of great help, for them to believe in themselves.*
- *I've always embraced collaboration, we've always used positive feedback … and it reminds me a lot of the Nurtured Heart approach. That's one teaching area … that uses that same active listening, positive feedback approach, embracing unique learning styles, engaging in full collaboration, making it an inclusive process for all kids, that I really, until they were singly identified to me, as I've learned through SciGirls … I don't know if I really would have said, "That strategy right there is going to help me engage girls, specifically."*

Preferred learning styles
- *There is value in guided procedure, to show scientific process and the reason why it is done a certain way. That does not mean the students cannot experiment with other methods or process, but it is OK to give some structure to create authentic experiences.*

2.2 Proposed additions

When invited to share proposed additions, a few educators suggested incorporating real-world STEM work contexts and a couple commented on growth mindset. Their comments are in Table 12.

Table 12. Proposed additions (N=24)

Incorporate real-world STEM work contexts
- *I would suggest including a strategy that would allow participants to visit on-site science locations that relate back to the specific activity; I think this would take the science experiment to another level by exposing youth to what the science field is really like; it would give the participants an opportunity to meet role models & mentors in their own environment, and what it is truly like to work in that specific field ... [the field trip idea] drives home the fact that it's real world ... and they see teams of people ... so I think that would be a great opportunity to take that hands-on up a notch.*
- *I would recommend including a list of places that would be most beneficial to go to that would open up the minds of young people in the field of science. Sort of like field trip ideas ... because [with the hands-on activities] and watching the episodes, [they were really interested. That's a main reason I mentioned field trips, because the girls asked about doing things like this after they saw the episodes.]"*
- *I think our expedition program has been a game-changer too because ... kids are always wondering why they have to learn what they're learning, or they don't really know what the real-life application is and a lot of science is really abstract, you kind of ... put your hands on it, so going to a workplace and a company to see what exactly that means is really beneficial for them.*

Growth mindset
- *I think it would be nice to have [growth mindset] be a strategy in itself ... Maybe it's within the tips or something, but maybe explicitly saying asking girls what their interest are. I think in the SciGirls packet, it's probably one of those tips within that strategy ... I think the goals themselves are great and do a really good job of engaging girls in STEM and are focused on that, and I think being explicit about the growth mindset and that resilience is so important. I think it's talked a lot in the booklet, I think there are tips about celebrating failure or celebrating the struggle, so I think its within there, but if someone were only to read the postcard, maybe it wouldn't be clear enough about this growth mindset idea and the resilience we need to help girls and helps kids in general be persistent and not give up when they're struggling.*
- *#5 ... positive feedback ... that's definitely not a problem I have ... but I kind of merge that with what we're expected to do at school, which is to provide frequent and immediate feedback ... I would try to add ... positive feedback or maybe constructive and positive feedback, for growth mindset ... moving forward ... establishing a growth mindset is more important than anything. This way, if you have that growth mindset ... if you don't make that mark that you intended, at least you know that this way you're going to pull yourself up by your bootstraps and keep moving forward and finding new collaborations, finding those individuals who can help and support you. We really don't want students feeling like they're alone.*

2.3 Other recommendations

Finally, when invited to share other recommendations for the *SciGirls Seven*, between one and three educators commented on each of the following topics: incorporating art in STEM, incorporating other topics, working with younger girls, strengthening educator resources or trainings, and increasing parental involvement. Their comments are in Table 13, below and on the following page.

Table 13. Other recommendations (N=24)

Incorporate art
- *I believe we should use the term STEAM, not STEM for the SciGirls program. It does help in bringing girls into STEM activities to know that art and creative activity is part of the process. They are much more likely to engage initially if there know this.*
- *Glitter is a big thing. Incorporating the STEAM in STEM – adding art – has also been a big tool for me in being able to talk to girls about things they might think are gross ... like anatomy ... and being able to do it in an artsy way. The "sparkle, sparkle" is the key to everything. Using art as a sort of vessel to teach science to girls especially, I find that to be a really effective tool because they can approach the subject and then after they're in it, they don't mind the yucky so much because they've already seen it in a less intimidating way.*

Table 13 Continued.

Incorporate additional topics in the programs
- *More science*
- *[More coding] … that's the only other thing that I don't really see in the program, is more coding.*
- *Integrating more Computer Science like coding, robotics, app development, agriculture, and the process involved in inventions … One thing I would love to see happening … is inventions. Teaching them the engineer design process, and having a platform … where students can come, compete, and be a part of … an inventions academy, inventions symposium, and just have the students use what they have – because that's what engineers do – to make it work. I would love to see that on a grander scale … while the hands-on [activities are] fun and engaging and it's real-time, I would always have something innovative, like I would be connected to the top tech agencies and communicating with them the type of things that they need for the industry. So, innovation, incorporating computer sciences and coding and things of that nature.*

Work with younger girls
- *I think if you can introduce them [to STEM and the strategies] right from maybe first grade, ages 6 or 7 … when they develop that interest right from that grade, maybe that could help.*
- *The other thing that I have found is that the younger that I reach them the better, because I find that if you can engage them when they're younger, when their curiosity is still very active, you can let that curiosity actually be the basis, their questions become the foundation of what you do. And as they get older, they become more defensive, more protective about themselves, and they tend to be less forthcoming with ideas and everything … they just become more self-conscious, I think … so I like to see them when they're younger and help them to build up this science identity, so that it becomes a part of them and they have to confidence to go on, continuing to express themselves and be engaged in STEM in general.*

Strengthen educator resources and trainings
- *I'd recommend including how-to videos for facilitators; this would make it easier to better present the activity to the group.*
- *Looking at ways in which to strengthen and support the training around the SciGirls Seven is always going to be an important aspect for me, as a trainer. And … to fully talk about the two styles of implicit and explicit teaching strategies … I'm really into studying what motivates adult teachers … and so I feel like, I'm going to forever want to keep my trainings robust … and keep my educators motivated and always thinking about it, so they don't move on to something else.*

Increase parental involvement
- *The way that I've gotten the most involvement, to get girls signed up for programming, is I contact the parent first. And that's been really helpful because then I can explain to the parent what the program's all about, then give the information to the children, and then the parent's already aware of the program and it also encourages their daughters or granddaughter … to go forth with the program … And actually I got really positive emails back from the parents … and phone calls … and they just keep saying, "Oh my gosh, I'm so glad you have a program like this, my daughter needs something like this." Because I don't think the students can come forth and say "I want to be more science-invested!" – especially at the middle school level. So the parents know what their children want, and also what the parents want for their children, so that's been really helpful … One thing, when I get a phone call back from a mother or a grandparent … I think when there's a female saying to their young female daughter or granddaughter that they want them to do it, I think that's a really positive role model in itself, that another woman is telling them to do it.*

Discussion

The overarching goal of *SciGirls CONNECT²* is to "investigate the hypothesis that STEM programs that use gender equitable and culturally responsive strategies contribute to girls' positive STEM identity development, including their sense of self-efficacy, persistence and aspirations around future STEM careers" (NSF proposal, 2015). As detailed elsewhere in the project description, the evaluation team's role in *SciGirls CONNECT²* is "to gather, analyze and summarize data that can facilitate the project's effort to revisit, refine and expand the *SciGirls Seven* and related strategies ... [prioritizing] methods that are interactive and iterative in nature over the grant period."

To that end, this formative evaluation of *SciGirls CONNECT²* presents information regarding educators' use of, reflections on, and recommendations relating to the *SciGirls Seven*. Their feedback was shared in two main areas: 1) Educators' use and perception of the *SciGirls Seven*; and 2) Educators' suggestions relating to the *SciGirls Seven*. Below, we look across the findings in each area to briefly summarize a few issues that might help inform the project's effort to revisit, refine, and/or expand the *SciGirls* strategies, a key project goal stated in the NSF proposal. Finally, reflecting on both areas considered in this Discussion, a few additional observations are shared in conclusion, with a focus on issues that relate more directly to the forthcoming development work on the strategies in the coming months.

With that being said, caution should be taken in drawing broad implications from the findings, given that the evaluation relied on a relatively small sample of 24 educators from 13 partner organizations to provide feedback, some of whom were less familiar with the *SciGirls Seven* than others. However, the evaluation team informally noted that educators with all levels of experience provided thoughtful feedback about the strategies. In general, those who were relatively new to the *SciGirls Seven* approached them from a fresh perspective, and those who had used the strategies for years drew on a broad base of experience in their reflections.

Educators' use and perception of the *SciGirls Seven*

Individual *SciGirls Seven* strategies

The evaluation sought educators' feedback on each of the *SciGirls Seven* strategies at various points in the formative survey and follow-up interview, which – when combined and looked at by individual strategy – amount to considerable feedback on each strategy's value, use relative to other *SciGirls Seven* strategies, and impact on both specific key outcomes envisioned by TPT and girls' STEM identity more broadly.

Perceived value and outcomes of individual strategies
The educators' feedback on the perceived value and impact of each of the seven strategies is summarized below.

> **#1 Having girls collaborate/work together:** Overall, educators found strategy #1 *extremely valuable* and the majority confirmed that they saw it result in a key outcome TPT

envisioned for the strategy, namely *energizing girls* (70%), as in, "*The girls enjoyed working together and there was a sense of cooperation which energized the girls.*" A smaller group of two-fifths of the educators also pointed to this strategy being among the most important *SciGirls Seven* strategies for facilitating the STEM identity impacts they observed among girls (40%).

#2 Having girls work on a project designed to be personally relevant and meaningful: Overall, educators found strategy #2 *extremely valuable* and most confirmed that they saw it result in a key outcome TPT envisioned for the strategy, namely *motivating girls* (90%), as in, "*Having them work on projects that were relevant to them made them more interested and motivated them to keep trying until they made a successful project.*" One-quarter of educators also pointed to this strategy being among the most important *SciGirls Seven* strategies for facilitating the STEM identity impacts they observed among girls (25%).

#3 Having girls participate in hands-on, open-ended projects and investigations: Overall, educators found strategy #3 *extremely valuable* and most confirmed that they saw it result in a key outcome TPT envisioned for the strategy, namely *helping girls enjoy participating* (89%), as in, "*They came back and wanted to work on projects at non-designated times. They took things home to work on between meetings.*" A smaller group, just under half of the educators, also pointed to this strategy being among the most important *SciGirls Seven* strategies for facilitating the STEM identity impacts they observed among girls (45%).

#4 Having girls approach projects in their own way: Overall, educators found strategy #4 *extremely valuable* and most confirmed that they saw it result in a key outcome TPT envisioned for the strategy, namely *motivating girls* (94%), as in, "*With them approaching the activity in their own way it made them feel more confident in themselves which motivated them.*" Elsewhere in their surveys, a few educators cautioned that this strategy was best implemented within set parameters, as in, "*I believe having girls approach the project in their own way is needed up [to a point], however, each lesson or activity always has some parameters that they need to stay within due to having proper materials and space.*" A smaller group of two-fifths of the educators also pointed to this strategy being among the most important *SciGirls Seven* strategies for facilitating the STEM identity impacts they observed among girls (40%).

#5 Giving girls specific, positive feedback on their efforts, strategies, and/or behaviors: Overall, educators found strategy #5 *extremely valuable* and most confirmed that they saw it result in a key outcome TPT envisioned for the strategy, namely *improving girls' confidence* (89%), as in, "*This absolutely improved their confidence and performance. By giving positive feedback, it made them know that you were actually paying attention to them and their creation. It also made them work harder and think more critically knowing that I was going to give them feedback.*" About a third of educators also pointed to this strategy being among the most important *SciGirls Seven* strategies for facilitating the STEM identity impacts they observed among girls (35%).

#6 Encouraging girls to think critically: Overall, educators found strategy #6 *extremely valuable* and most confirmed that they saw it result in a key outcome TPT envisioned for

the strategy, namely *improving girls' confidence and trust in their own reasoning (*79%), as in, "*Yes - they felt empowered to figure things out and we could see them using these same techniques with their families when they challenged them to the dough creature activity.*" About a third of educators also pointed to this strategy being among the most important *SciGirls Seven* strategies for facilitating the STEM identity impacts they observed among girls (30%).

#7 Having girls develop relationships with role models or mentors: Overall, educators found strategy #7 *extremely valuable* and most said they saw it result in a key outcome TPT envisioned for the strategy, namely *inspiring and motivating girls* (89%), as in, "*This truly made a difference … it was inspiring for the girls to see women in real life talk about their career in the science field.*" However, some explained elsewhere in their surveys and interviews that they had trouble locating role models or making the most of their visits, as in, "*… I wish we had incorporated the role models into activities that they could participate in with the girls*" and "*What I noticed is that the girls were super excited to meet these women who were so successful in their fields … and it was really cool to have the girls chat with these scientists, but I noticed that after about 15 minutes, even though they were really excited in the beginning, they started to fade a little bit. So I felt, for next time, we would have a quick chat but then have the role model … be involved in some sort of activity that relates to the topic of the day [and also to their field] … it could be even a game … to be more involved with the girls on a hands-on, personal level then just [giving a talk and having the girls ask questions].*" A smaller group of educators, but still a majority, also pointed to this strategy being among the most important *SciGirls Seven* strategies for facilitating the STEM identity impacts they observed among girls (65%).[8]

Looking across the educators' individual strategy responses, the findings indicate that they generally found each of the seven strategies *extremely valuable* to their Year 1 programs and the majority (between 70% and 94%) reported that they had observed each strategy result in a key outcome that TPT envisioned for that strategy.

The findings also indicated that the educators generally observed the strategies facilitate STEM identity impacts among girls, but that they felt some strategies impacted STEM identity more than others, particularly strategies #7 Having girls develop relationships with role models or mentors (65%), #3 Having girls participate in hands-on, open-ended projects and investigations (45%), #1 Having girls collaborate/work together (40%) and #4 Having girls approach projects in their own way (40%), as detailed above. Given that the formative survey asked which strategies, if any, educators found most important in facilitating the impacts they observed, most pointed to a strategy or strategies but did not comment further on their selections. A few educators were asked to elaborate in their follow-up interviews where time permitted, but in most cases this line of questioning was not addressed as part of the formal interviewing process. Among those who *did* elaborate in their interviews, at least one educator each said they thought strategies #1 and #5 impacted girls' confidence, strategy #2

---

[8] Additional feedback from educators about *SciGirls Seven* strategy #7, Girls benefit from relationships with role models and mentors, may be found in Knight Williams' *SciGirls CONNECT2 Implementation evaluation: Year 1 outreach programs.*

impacted girls' interest in participating in STEM, and strategy #7 affected their perception of STEM careers and professionals.

Strategies used most and least often
The above findings indicate that the educators generally found each of the seven strategies valuable, successful in meeting key envisioned outcomes, and impactful in facilitating STEM identity. When asked about their relative use, however, the educators indicated that they tended to use some strategies more or less often than others.

Most frequently the educators pointed to using two strategies the most: #1 Having girls collaborate/work together (43%) and #3 Having girls participate in hands-on, open-ended projects and investigations (43%), with some describing girls' positive responses to these strategies or citing their ease of use. Smaller groups (17% - 26%) said they used each of the five remaining strategies most often.

As for those strategies used least, two-fifths of the educators pointed to strategy #7 Having girls develop relationships with role models or mentors (43%), while smaller groups (0% – 22%) pointed to each of the six remaining strategies. As mentioned above, some of those who reported using strategy #7 least often noted that this was because they had trouble finding role models or making the most of their visits.

While the educators' feedback on their most and least used strategies offers some insight into their practical value, it is also important to note that the formative survey question posed to the group was open ended, not tied to any specific context, and exploratory, which led to some strategies receiving little or no mention in the survey format. Additionally, there generally wasn't time to gather more information about the educators' comparative use of the strategies in the follow-up interviews, given the educators' limited time and the competing priorities of the evaluation. Factoring in the above limitations, while the evaluation team's exploratory approach in the current evaluation helped uncover how the educators' thought about their most and least used strategies, without tying them to a specific ranking scheme, the team could consider changing the phrasing of this survey question in Year 2 in order to address the relative frequency with which educators use the updated strategies, to the extent that frequency of use is still deemed a relevant way of looking at the strategies.

Whether educators thought any strategies were redundant
Reflecting on their use of the strategies in their Year 1 programs, most educators said they did not find any of the strategies redundant (90%). One each said they found strategies #1 and #4 redundant (5% each), describing #1 as a "*duh strategy*" and #4 as "*intuitive.*"

Whether educators thought any strategies were best used in combination
Although no one combination was mentioned by the majority of educators and nearly one-third declined to identify any strategies that were best used in combination (30%), some educators did feel some strategies were best used in combination.

- Nearly one-third of the educators pointed to strategies #2 through #4, with most in this group specifically suggesting combining strategies #2 and #4 (30%), as in, "*[These two]*

kind of go hand-in-hand, because you allow the students to express their learning styles, and that leads to the activities or the experiences being personally relevant."

• One-quarter thought strategies #5 and #6 could be combined (25%) (as in, "*We critiqued each other's' work as a group, and I let the girls critique me too, and we were giving positive feedback at the same time*"), and smaller groups suggested combining #1 and #3 (15%) (as in, "*Because when you're doing hands-on, open-ended projects, you are collaborating by nature*"), or shared miscellaneous suggestions (20%).

As shown in their responses in Part 1 of this evaluation report, some of the educators qualified these suggestions and said that, even though they thought particular strategies *could* be combined, they still tended to think of them as separate strategies.

SciGirls Seven strategies overall

In addition to eliciting educators' feedback on each of the individual *SciGirls Seven* strategies, the evaluation also sought their perspectives on the strategies in a broader sense in terms of: what they perceived to be the goal of the *SciGirls Seven*; which resources they found most helpful in implementing the strategies; how they considered the strategies in planning and implementing their programs; whether they shared the strategies with their youth; and the types of STEM identity impacts, if any, they observed among girls as a result of using the strategies. Their responses to these broader questions are summarized below.

Goal of the SciGirls Seven
When asked about the overall goal of the strategies, the majority of educators said they thought the goal was to engage girls in STEM (70%), generally matching the primary goal of the strategies as envisioned by TPT. Smaller groups thought the strategies were intended to inspire careers in STEM (45%), be a tool for educators (30%), and show girls a new way of learning (25%). When subsequently asked to reflect on their own use of the *SciGirls Seven* in Year 1, and whether they felt the overall goal of engaging girls in STEM was reflected strongly in the strategies, all of the educators agreed that it was (100%), and two of the educators pointed to an additional goal of engaging girls in learning more generally. A few elaborated that they thought the strategies were effective at engaging girls *and* boys.

In addition to engaging girls in STEM learning, some educators noted that the strategies were a tool for teaching as well as learning about STEM, as in, "*I think [the overall goal of the strategies is] two-fold. From an educator perspective, it really helps you to take yourself out of the occasion when you're designing a program … [the SciGirls Seven allow you] to make sure you're designing in a way that the students are going to learn best, and not in a way necessarily that will be easiest to teach. And that can be challenging … From the girls' perspective … the objective is obviously to increase their interest in STEM fields and in STEM topics.*" Others commented throughout their surveys on how the strategies have a broader overall application to learning, noting, for example, that they "*[engage youth] in learning how to learn more generally.*"

Most useful resources when implementing the SciGirls Seven
When asked which resources they found most useful in helping them implement the *SciGirls Seven* during their programs, no one resource was named by the majority of educators. Just under half pointed to the activities (48%), while about a fifth cited the CONNECT website (22%), with other resources being mentioned by smaller groups of educators, including the *SciGirls Seven* resources (13%), episodes or clips from episodes (13%), women in STEM videos (4%), the trainings (4%). Throughout their surveys, some of the educators commented on the convenience of having the strategies "built in" to each *SciGirls* activity, as in, "*The activities are designed to easily implement each of the SciGirls Seven strategies*" and "*The SciGirls activities just include the strategies.*" Given this feedback, TPT may want to provide guidelines for using the updated *SciGirls Strategies* in the older activities, when the time comes, and consider doing the same for the media resources that were relied on less frequently.

How the SciGirls Seven were considered
When asked to describe *how* they considered the *SciGirls Seven* when planning and implementing STEM projects and experiences for girls, the educators generally commented on *how*, *why*, and/or *when* they considered the strategies. Among those who addressed *how*, more than half said they prioritized one or more strategies consistently (55%). About a third explained that they used the strategies synergistically or as a set (35%), a fifth used different strategies in different situations (20%), and a tenth shared miscellaneous comments (10%).

In comparison, when a similar question was asked in the front-end survey, more than half of the educators who commented on *how* they had used the strategies in previous programs (n=21) described using them synergistically or as a set (57%), while one-third explained that they used one or more strategies consistently (33%), among other responses. The full wording of the front-end survey question is shared below to show the examples and additional guidelines provided, which may have influenced educators' responses:

> Please describe how you consider the *SciGirls Seven* strategies when planning and implementing your STEM projects or experiences for girls. For example, do you typically use one or more specific strategies consistently, all 7 strategies synergistically/as a set of strategies, or do you find individual strategies useful in different applications? ***Please realize there is no right or wrong answer here, we are just trying to better understand how educators tend to think about and practically use the strategies. Feel free to describe any other ways that you consider the strategies that we haven't thought of as well!***

Noting that the front-end question guidelines provided language references the educators might not have otherwise used, such as "synergistically/as a set," the guidelines were removed from this question in the formative survey in order to understand how educators thought about their use of the strategies in planning and implementing their programs without the prompt. In response, while most educators addressed *how* they considered the *SciGirls Seven* in their formative survey (87%), many instead or also addressed *why* or *when* they used the strategies. The phrasing of this survey question again indicated that there was "*no right or wrong answer*" and that the evaluation team was "*trying to better understand how educators tend to think about and practically use the strategies.*" The range of categories that emerged within each of the *how, why, and when* responses can now be used to further refine

the language of any questions related to this theme in Year 2, allowing for both open-ended reflection but also close-ended consideration of specific categories that emerged from the front-end and formative work to date.

Whether educators shared the SciGirls Seven with their youth

When asked if they shared the *SciGirls Seven* with their Year 1 program youth, just over half said *yes* (55%) and just under half said *no* (45%). Among those who said *yes* some thought sharing the strategies could increase girls' (and parents') awareness of their learning and growth or might be useful to them beyond the *SciGirls CONNECT²* program, as in, "*Working with the girls, and especially the girls that have been with our program for so long … when we start a new subject or lesson and [tell them we're going to work in groups of 4], they're like, 'Strategy 1!' But … the girls in STEM movement doesn't happen in a vacuum. They're going to go back to their classroom [or out into the real world] and they're not going to have a super-safe all-girls environment where they get to be themselves, so we think that arming them with the strategies ahead of time and them really knowing it helps them be better advocates for themselves.*" A few of the educators cautioned that they weren't sure how much information about the strategies their girls actually "*absorbed*," particularly in a limited timeframe; further evaluation would be needed to assess the short- and longer-term impact of sharing the strategies with youth in *SciGirls* programs.

Impact of the SciGirls Seven on girls' STEM identity

To help frame educators' responses relating to STEM identity, the formative survey gave them the definition of STEM identity used by the *SciGirls CONNECT²* research team in their correspondence with TPT and the partner organizations:

> STEM identity integrates confidence, interest and motivation around STEM, and ultimately affects choices, behaviors, persistence, and perceptions of STEM careers and STEM professionals.

In response, most of the educators indicated that they observed an impact on girls' STEM identity as a result of using the strategies during their Year 1 programs (87%). Notably, their responses generally pointed to impacts they observed relating to the definition's individual components of confidence, interest in and engagement with STEM, and interest in and perceptions of STEM careers and professionals, rather than how they saw these components integrated. Specifically, the majority in each case saw an increase in girls' confidence (60%) and/or an increased engagement with or interest in STEM (60%). Smaller groups observed an increased interest in STEM careers or professionals (40%) or shared miscellaneous responses (15%). A number of educators shared responses that touched on each of these three impacts, as in, "*The students' STEM identity was positively impacted. They developed confidence, interest and motivation around STEM subjects and realized that they could be scientists.*"

While most educators reported that their use of the *SciGirls Seven* in their Year 1 programs impacted girls' STEM identity in some way, more than a tenth said the question was *not applicable*, for unknown reasons (13%). Due to length, the survey did not probe for more information in these cases. Additionally, these educators either did not complete the follow-up interview or were not asked to elaborate due to time constraints during the interview. Given

the potential importance of STEM identity considerations to the updated strategies, this could be an area for follow-up in the educators' Year 2 reflections.

Educators' suggestions relating to the *SciGirls Seven*

Educators were asked to share revisions and suggestions to the *SciGirls Seven* in their formative survey and follow-up interview. They were also given an opportunity to "think outside the box" and offer additional recommendations in an effort to leave open the possibility of changes to the *SciGirls Seven* beyond updates or modifications. Summarized below, all of the educators' proposed revisions, additions, and recommendations are shared in depth in Part 2 of this evaluation.

‐ When invited to share proposed revisions, the educators, as a whole, commented on five topics addressed in the current *SciGirls Seven*: relevance (including cultural relevance), collaboration, role models, positive feedback, and preferred learning styles.

‐ When invited to share proposed additions, a few each suggested incorporating real-world STEM work contexts or commented on growth mindset.

‐ Finally, when invited to share other recommendations for the *SciGirls Seven*, between one and three educators commented on each of the following topics: incorporating art in STEM, incorporating other topics, working with younger girls, strengthening educator resources or trainings, and increasing parental involvement.

As detailed throughout this evaluation and the front-end evaluation, many of these topics were touched upon by educators in the front-end survey, formative survey, and follow-up interview. Appendix 2 presents select quotations from these three sources of feedback, grouped by a different-yet-related set of themes that were identified by and organized for the *SciGirls CONNECT²* literature review team: identity and personal relevance; learning environments; collaboration; hands-on, open-ended activities; role models; cultural responsiveness; growth mindset; gender in STEM; and additional help or guidance educators may find useful in their work to implement the *SciGirls Seven*.[9]

Additional observations for consideration in ongoing strategy development

The evaluation team conducted this formative evaluation at roughly the same time that the literature review and project teams worked to develop the updated strategies. Meeting on a monthly basis, the teams shared relevant information that they thought would inform each other's scope of work. As an example, the evaluation team twice shared summaries of the educators' responses to the front end and formative evaluation and also prepared the front-end evaluation report referenced earlier.

---

[9] Appendix 2 was created for the project and literature review teams in late January 2018, in advance of this formative evaluation.

As of the writing of this report, the literature review and project teams are finalizing their draft of the updated strategies, which will be presented to the educators at a webinar in March 2018.

As captured in Image 4, moving forward, the evaluation team will focus on efforts to understand the impact of these forthcoming, updated *SciGirls Strategies* on educators and their programs. Specifically, in the coming months, the evaluation will first explore educators' immediate

Image 4. Overview of partner educators' evaluation activities

reactions to the updated strategies, including how they anticipate using them in Year 2 of their programs, whether they anticipate any challenges or concerns, how they think their programs might change or benefit, which strategies they anticipate using the most and why, and the types of changes, if any, they anticipate seeing in their girls' interest in STEM studies and careers. Looking ahead to Year 2, the evaluation team will continue to gather, analyze and summarize data regarding educators' use of, reflections on, and recommendations relating to the updated strategies, to help facilitate the project's effort to finalize the updated *SciGirls Strategies*.

In the spirit of assisting the literature review and project teams' ongoing development of the updated strategies, the following observations from the current evaluation may be of use:

➲ The educators consistently, and correctly, identified the overall the goal of the *SciGirls Seven* and subsequently consistently concurred that this goal of STEM engagement was strongly reflected in the strategies. These findings indicate that TPT has successfully communicated this overall goal and that educators' experience with the strategies aligns with their intended use. If, however, the overall goal of the updated strategies shifts from or expands upon STEM engagement in some way, it will be important to clearly convey this change to the educators, particularly those who are accustomed to using the strategies in this STEM engagement capacity. This may prove somewhat easier among educators who are fresher to the strategies than those who have been working with them for years, noting that both types of educators were represented in this evaluation.

➲ It is encouraging that the educators generally rated all seven strategies *extremely valuabl*e and that they generally reported they had observed each strategy result in the key outcome TPT envisioned. Moreover, most educators further reflected that, because of their use of the strategies, they had observed an impact on girls' STEM identity as defined by the *SciGirls CONNECT²* project. The educators' responses tended to focus on what they observed about the individual components of STEM identity, per the definition provided, rather than on their integration. Specifically, three-fifths each said they saw an increase in
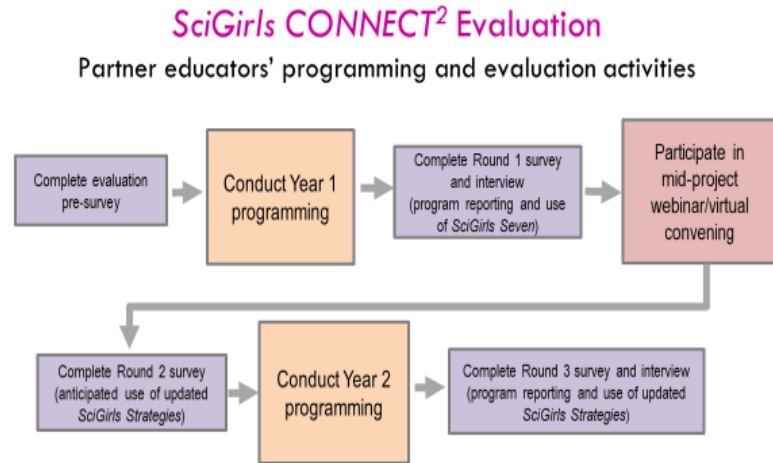
girls' confidence (60%) and/or an increased engagement with or interest in STEM (60%), while two-fifths observed an increased interest in STEM careers/professionals (40%). When the educators were asked to consider whether any strategies were particularly important in facilitating the impacts they identified, between one-quarter and two-thirds (25% - 65%) pointed to each of the seven individual strategies. Their responses also indicated that strategies #7, #3, #1, and #4 may have played a heightened role

Following from the first bullet point, if a focus on STEM identity becomes part of the overall goal of the updated strategies, it may be important to remember that educators have thus far been largely focused on STEM engagement and may need guidance in shifting their thinking about the intent of the strategies. Towards this effort, it may help to look more closely at the language of educators' responses in this evaluation around the impacts they observed relating to STEM identity.

➲ The educators tended to use two sources to facilitate their work with the strategies, and most often relied on the *SciGirls Seven* complete guide and the two-page reference, as opposed to the postcard or other sources. Given the educators' apparent preferences, it might be important to prioritize these two primary source materials and ensure they are as user-friendly as possible and contain the core information that needs to be communicated. Alternatively, if TPT feels the postcard, for example, is a convenient and useful source, it might be worth rethinking its design, promotion, or distribution to help increase its use across programs.

➲ There was some discrepancy in how educators considered the strategies in planning and implementing their programs. Some prioritized one or more strategies consistently, some used the strategies synergistically/as a set, and some used different strategies in different situations. If TPT prefers educators adopt one of these three approaches over the others, it may be important to highlight the preferred approach when presenting the new strategies and explain this preference. Alternatively, if these three approaches, or any other approaches, are deemed equally desirable, it may be worth informing educators about the virtues of this flexibility, and, in turn, offer them examples of the different types of scenarios shared in this report.

➲ The educators' reporting around the strategies that they used most and least often further showed that they tended to use some strategies more than others. Depending on how the strategies are updated for the coming year, it may be worth looking more closely at the reasons why some strategies – for example, strategy #7, involving the use of role models – were used less often, and consider what might be added to the source materials, trainings, or other professional development to help ensure greater use of these strategies. In the case of strategy #7, for example, it may be important to provide educators with additional support or suggestions about how to find role models and how to incorporate them in their programs, two key issues that the educators raised in this report. Note also that when invited to share proposed additions to the strategies, a few educators suggested incorporating real-world STEM work contexts, an idea that would likely include role model involvement.

⮞ It is encouraging that educators did not generally find any of the strategies redunant. They did offer clues, however, as to ways that some strategies, particularly strategies #2 through #4 and #5 and #6, might be used in combination. Looking more closely at the relationships between the strategies in each case may help inform TPT's decisions around whether these strategies, or others, might be grouped or related in ways that haven't thus far been considered or formalized.

⮞ While no one *SciGirls* resource was deemed most helpful by the majority of educators in terms of facilitating their implementation of the strategies, the *SciGirls* activities were named most often, by just under half of the educators (48%), with some of these educators commenting on the convenience of having the strategies "built in" to each *SciGirls* activity. As noted above, in light of this feedback, TPT may want to provide guidelines for using the updated *SciGirls Strategies* in the older activities, when the time comes, and consider doing the same for the media resources that were relied on less frequently.

Notably, much smaller groups of educators mentioned the *SciGirls* episodes (or episode clips) (13%) or the women in STEM videos (4%) as being most helpful in facilitating their implementation of the strategies. However, given, for example, the potential value of the mentors depicted in the *SciGirls* episodes and the role models depicted in the women in STEM role model videos in highlighting strategy #7 relating to role models, TPT might give further thought to communicating how these media resources relate to and can support educators' use of the strategies. Note also that when invited to share other recommendations for the *SciGirls Seven*, one suggestion involved strengthening the educator resources or trainings. In this regard as well, it might be worth looking more closely at the resources educators tended to prefer for facilitating their implementation of the strategies and thinking through how to play to this preference, while ensuring all resources reinforce the same ideas.

⮞ By updating the *SciGirls Strategies* with a focus on cultural responsiveness, the project hopes to "further help ensure that … educators, parents, and role models have the necessary tools and competencies … to effectively engage *all* girls in STEM" (NSF proposal, 2015, emphasis in original). In their front-end surveys, a few educators indicated that they "*[liked] the idea of [incorporating cultural] responsiveness*" to a greater extent, but that they were "*not sure how to address this*" in their programs. After further reflection on this issue, throughout their formative surveys and interviews, some educators elaborated on the value of making their programs "*personally relevant as well as culturally relevant.*" Additionally, one educator said she thought cultural relevance would be most impactful when incorporated throughout a program, rather than being the focus of a single *SciGirls Strategy*, as in, "*I don't think you need to add a cultural relevance strategy, but … if the culturally relevant piece is important, it's embedded throughout, it's not a stand-alone separate thing where you would check the box and say 'Ok we have a culturally relevant role model, we're done,' because that's not … really incorporating that important piece all the way throughout … I think it's also helping educators understand how to adapt, modify, be creative with their activities – even SciGirls activities – to make it relevant to the community that they live in.*" If TPT agrees with this recommendation, the project team might consider ways to embed cultural responsiveness throughout the updated *SciGirls Strategies*.

Ü Finally, since educators were evenly split on whether they informed their girl participants about the *SciGirls Seven,* it might be worth giving some thought to whether this issue should be more formally addressed as a desired approach. In this evaluation, some educators saw considerable value in being explicit about the strategies with their participants, noting short and long-term value with respect to STEM learning and growth. Moreover, when the educators were invited to share proposed additions, a few commented on the value of growth mindset and suggested this kind of awareness be more explicitly incorporated into the updated strategies, as in, "*I think being explicit about the growth mindset and that resilience is so important. I think it's talked a lot in the booklet, I think there are tips about celebrating failure or celebrating the struggle, so I think it's within there, but if someone were only to read the postcard, maybe it wouldn't be clear enough about this growth mindset idea and the resilience we need to help girls and helps kids in general be persistent and not give up when they're struggling.*"

No specific downsides of informing girls about the strategies were mentioned, although a few educators indicated their girls didn't need to know or shouldn't know of the strategies but didn't elaborate, as in: "*The strategies] should be part of your planning but the girls should never know they exist,*" and *"To me they're like the behind-the-scenes strategy of implementing something, and it's like revealing the recipe."* If TPT decides to suggest that educators let their girls know about the strategies in some form, then it may be important to factor in such educator perspectives and further explain the rationale and benefits.

Appendix 1
SciGirls Seven two-page reference

The SciGirls Seven
Proven Strategies for Engaging Girls in STEM

The **SciGirls** approach—for the TV show, website, and educational materials—is rooted in research about how to engage girls in STEM. A quarter of a century of studies have converged on a set of common strategies that work, and these have become **SciGirls'** foundation. We call these strategies the **SciGirls Seven.**

1.   Girls benefit from collaboration, especially when they can participate and communicate fairly. *(Parker & Rennie, 2002; Scantlebury & Baker, 2007; Werner & Denner, 2009)*

Girls are energized by the social part of science—working and learning together. Provide opportunities for small group work, and encourage girls to talk about their ideas and consider all possibilities before digging in. Make sure discussions remain respectful and inclusive, and that each girl's contributions are valued. Girls are likely to remember not only what they learned, but also how they felt when they learned it.

> "Whenever you come together with a team, you can find the answer to any question."
>
> Josie, age 12

2.   Girls are motivated by projects they find personally relevant and meaningful.
(Liston, Peterson & Ragan, 2008, Lyon & Jafri, 2010; Mosatche, Matloff-Nieves, Kekelis, & Lawner, 2013; Patrick, Mantzicopoulos, & Samarapungavan, 2009; Thompson & Windschitl, 2005)

Girls become motivated when they feel their project or task is important and can make a difference. Support them using STEM as a tool to explore issues or topics they care about. If they see how STEM is relevant to their own lives and interests, their attraction to these subjects is likely to increase.

3.   Girls enjoy hands-on, open-ended projects and investigations.
(Chatman, Nielsen, Strauss & Tanner, 2008; Denner & Werner, 2007)

SciGirls promotes exploration, imagination, and invention. Encourage your girls to ask questions and find their own paths for investigation.

For more information, go to scigirlsconnect.org

SciGirls | PBS KIDS

7

4. **Girls are motivated when they can approach projects in their own way, applying their creativity, unique talents, and preferred learning styles.** *(Calabrese Barton et al., 2013; Calabrese Barton, Tan, & Rivet, 2008; Eisenhart & Finkel, 1998; Lyon & Jafri, 2010)*

Encourage girls to develop their own ways of exploring and sharing knowledge, paying attention to the unique learning styles that motivate your group. You may be surprised by what creative, exciting approaches girls come up with when designing investigations, collecting data, and communicating results.

5. **Girls' confidence and performance improves in response to specific, positive feedback on things they can control—such as effort, strategies, and behaviors.** *(Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 2000; Halpern et al., 2007; Kim et al., 2007; Mueller & Dweck, 1998)*

Self-confidence can make or break girls' interest in STEM. Foster their efforts, compliment their strategies for problem solving, and let them know their skills can be improved through practice. Celebrate the struggle. Wrestling with problems and having experiments fail is a normal part of the scientific process!

6. **Girls gain confidence and trust in their own reasoning when encouraged to think critically.** *(Chatman, Nielsen, Strauss & Tanner, 2008; Eisenhart & Finkel, 1998; Kim et al., 2007)*

Cultivate an environment in which asking questions and creative thinking are a must. Throughout the centuries, this same trust in logic and re-examination of ideas made advances in science, technology, and engineering possible.

7. **Girls benefit from relationships with role models and mentors.** *(Holmes, Redmond, Thomas, & High, 2012; Liston, Peterson & Ragan, 2008; Lyon & Jafri, 2010; Mosatche et al., 2013; Weber, 2011)*

Seeing women who have succeeded in STEM helps inspire and motivate girls, especially when they can relate to these role models as people with lives outside of the lab. Role models and mentors not only broaden girls' views of who does science, but expand girls' vision of what's possible in their own lives.

8

Appendix 2

Selected quotations from *SciGirls CONNECT²* educators' pre-program surveys (N=31), post-program surveys (N=24), and post-program interviews (N=20), as of 1.31.18

Grouped by theme
(including notes shared by the literature review team)

<div style="border:1px solid #000; background-color:#b0bcd8; text-align:center;">

Identity and personal relevance
**(include tapping into students' funds of knowledge e.g. background,
knowledge and experiences; connecting STEM learning to students' everyday life)**

</div>

Pre-program survey quotations
- *By providing the ability for them to get their hands dirty and dive into a project and make it their own, you give them the opportunity to engage in their own way/at their own speed.*
- *They are motivated when they feel they have a special piece they can contribute to a project.*
- *Every girl is unique and they also believe they have different learning skills, talents and abilities. After each project, they came up with different creative results.*
- *As stated above, many of our girls have gone from fear or empathy towards science/STEM to excitement and an increased confidence in their abilities.*
- *I have seen them become more interested in STEM activities and become more engaged in the activities.*
- *Girls are more interested in the activities and as are result look forward to working together on projects, trying new things and exploring their own personal creative style and way of thinking.*
- *I have witnessed them get more excited about learning and exploring the world of STEM.*
- *The girls have a vision for their future. Some of them are leaning towards STEM careers.*
- *Desire to pursue engineering, cybersecurity, and computer science careers.*
- *Self-perception in ability to do math and science improved.*
- *Because these girls have not understood science to be relevant for their lives, it is imperative to demonstrate that relevance to them in order to engage them and encourage them to participate. If we do not do this we lose them.*
- *I have also seen girls get excited about projects they might not have known exist before and … they expand their relevancies.*
- *I think perhaps not all the projects end up being personally relevant and meaningful to every girl.*
- *We are not seeing the projects motivate girls yet. Often, our girls have not been encouraged to think creatively.*

Post-program survey quotations
- *The students' STEM identity was positively impacted. They developed confidence, interest and motivation around STEM subjects and realized that they could be scientists.*
- *Confidence increased, interest in participating in activities increased, role models impacted students by showing them what a meteorologist and a scientist look like. By the end behavior was increasing.*
- *[On the subject of revising the SciGirls Seven], I feel that the girls need to be excited about a topic but they don't necessarily need to find it relevant in the beginning. I believe it expands their knowledge of what they think of a specific topic.*
- *The girls speak more confidently about their reasoning and findings to adults and teachers. They confidently share [what] their favorite part of the week was and what they will be when they grow up which is often a job that a role model has.*
- *I think the personally relevant strategy could be amended to general subjects that girls find interesting … it's hard to know what each of the girls' specific interests are but what do girls' interests trend to be - environment, life science, etc.? Help an educator out so that they have a starting place instead of feeling overwhelmed on not knowing what exactly [they] are interested in.*
- *There was one group that had difficulty with this as they could not agree on what was relevant and meaningful (interesting) to them. They compromised and still did a great project, but they did not seem as enthused as the other groups.*
- *I believe having girls approach the project in their own way is needed … however, each lesson or activity always has some parameters that they need to stay within due to having proper materials and space.*
- *The girls didn't have a lot of STEM exposure, so it felt like every project was a project of disinterest UNTIL they tried it and realized they like it. It was also hard to do projects the students wanted due to budgeting and time constraints. A lot of the SciGirls projects were greater than 2 hours, which is a major challenge when operating under … the school system.*

Post-program interview quotations

- *I feel like I combine the 2nd and 4th [strategies] because … I think of those in the same vein, but I do think they're separate strategies, and it makes sense that they are – just this idea that there's a bigger purpose, and with a bigger purpose they're able to apply it in their own way, and approach it in the way they want to.*

- *[One of the most important parts is] giving [the girls] a purpose or a reason, or if you're not giving them one, letting them create one.*

- *I noticed that showing interest in the girls and what they're learning, like asking questions … I think it goes to the SciGirls Seven strategy of relevance, having projects that are relevant and meaningful to them, but I think part of that is talking to girls, like, "What are they interested in? Why did you sign up for this program, and what do you want to learn?" I think forming that relationship is also part of that role model/mentorship strategy as well. [In our program, we were doing a flower dissection and one girl said, "Are we dissecting an eye???" and we said, "Do you want to dissect an eye? Do you like to do that?" and all these girls were like "Yeah" so we found time in the program to add that to the activities, and later in the week when we asked them what they liked, that was one of their favorite things and I think it stemmed from hearing what they were interested in] …*

- *… I feel like there's something missing … Maybe having one more piece that wraps it up would be more of a complete experience for the girls and would have more of a lasting impression on them … Maybe it's just a piece of the activity, as part of the role model, have them follow up or do a Skype or do a letter or something … I just feel if there was one more piece of that, it would really be very specific to girls … I think these are really great strategies and I think they work really well with girls, but I also think they work well with underserved youth too … Working with this last group, I would have loved to have done more reflection. Doing some of the activities that we did, and then scaling that up into a reflection. [For example, if you do the buoyancy activity, taking that and then talking about the jobs that are available, or how it relates to their local environment/community.] Getting them to think about how they can take activities that they've done and apply it to their very small neighborhood and then scale it out from there … [this is what I was getting at earlier, about adding one more piece].*

- *At the end of this entire SciGirls program, I've seen a lot of them become a lot more interested or eager to do science or STEM. Every week they would ask, "Are we going to do SciGirls today?" … for me, that shows me that … their identity in themselves became more clear and they know what they want to do, they know what they want to achieve, and they just want to do projects that are part of their interest, and that's SciGirls!*

- *Through each lesson, I noticed the girls' confidence growing, both with their individual answers … but also in their group work and taking more leadership … the girls that were really quiet in the beginning [were leading by the end] … one girl, that was her favorite part because she really got to be in control of what she was learning, how she was learning it, and how she was presenting that information not only to her peers but to her family as well. And we had the girls … [learning about each part of the scientific process in our lessons, i.e. data collection, methods, etc. … they came up with questions at the meeting, we helped them develop them], and toward the end they were asking more in depth questions, which led to other questions, so their critical thinking stills really grew.*

- *I know that one of the SciGirls strategies talks about making personal connections and real-world applications … I think that can be really hard because you don't always know what the girls find personally relevant, and for us we see so many different girls over the course of time that it would be really hard to figure out and gauge and inventory what they find personally relevant and motivating. So, what are some trends overall that you can kind of have as, "Well, we know girls are really interested in helping sick kids," [so] let's find a pediatric oncologist … like, trends over time would be really helpful … And I am also in the camp of "girls don't know what they don't know," so if they've never been exposed to engineering, that doesn't mean that they don't like it, they just have never had it. So … exposing them to a breadth of subjects is important, but … I'm interested in how SciGirls chooses their videos and activities … I have a hard time believing they [decided] to do a full-length episode based on something that no one cares about … obviously they have a system, so how do educators tap into that system too?*

- *When I start out [before and after I meet the girls], I look at the activities and see which activities I think the girls … could apply to real-world things that happen, maybe in their everyday lives … as long as it applies to something that they enjoy learning, I've learned that really helps, so I'll look at the activities and see which ones I think that the girls I specifically have would be interested in, and then I go from there. I [also] do some activities they probably wouldn't be interested in, just to give them [additional exposure], but when I'm looking at planning, that's the main thing I'm looking at … I've been teaching middle school for about 10 years, so I kind of have a handle on the things they're kind of interested in. But I learned, each group that I have seems to be a little different. Like, this group, I didn't think that they would really enjoy the electric part, doing the Play-Doh, and I actually even did a little coding with them, [and] they seemed to like getting on code.org … so they were more interested in those kinds of things [than kids I've worked with on other SciGirls programs], so it just depends on the group … I think I had more engineers this time!*

- *… we really try to adapt our lessons … for [our diverse communities] … [for example, we did a lesson about the ocean and climate change and] one student asked, "How is my going to get a water bottle at the store making an impact?" It was the perfect question to really just dive into that, because he had no idea … it was such a simple question but had such an impactful answer, because he really just had no idea how peoples' acts could make a difference … Whatever they're interested in, it's obviously relevant to them because they're asking about it, they're curious about it.*

- *… if you're making them relevant, [if girls are having a choice in the topics or questions,], they're going to approach it in their own way … I think [strategies #2 and #4] overlap, but they address different things, because there's personal relevance and then there's learning style and how they approach that subject that's meaningful. I don't think they're redundant so much as they're scaffolded, almost, they almost work within each other.*

- *… it felt like a couple of them could have been merged … personally relevant and preferred learning styles … those are the two that I felt … kind of go hand-in-hand, because you allow the students to express their learning styles, and that leads to the activities or the experiences being personally relevant.*

- *I think the most important thing is to make it relevant. I just think that girls need to know it affects their own life. I always say science is everywhere, it's us, it's everything around us. And so, I always speak to the science of everything when we're talking*

[about] – down to, you know, down to nail polish – whatever it is that they're talking about, we talk about the science of it. So I just make it really relevant to their lives, so it isn't something that's out there, abstract … it just needs to be real for them.

- *We weren't able to do a lot of this [in our program, for various reasons], but in the past I have done … projects that the students actually choose themselves, and allowing them to choose what they worked on really made a difference. I feel like it really allowed them to work with their own interest, and because of that they were able to focus more, they were paying more attention … so I felt like they took away a lot from it … [and after those lessons] I feel like I would get a lot more questions [like], "What would happen if we did this and that?"*
- *The other thing that I have found is that the younger that I reach them the better, because I find that if you can engage them when they're younger, when their curiosity is still very active, you can let that curiosity actually be the basis, their questions become the foundation of what you do. And as they get older, they become more defensive, more protective about themselves, and they tend to be less forthcoming with ideas and everything … they just become more self-conscious, I think … so I like to see them when they're younger and help them to build up this science identity, so that it becomes a part of them and they have the confidence to go on, continuing to express themselves and be engaged in STEM in general.*
- *I think if you can introduce them [to STEM and the strategies] right from maybe first grade, ages 6 or 7 … when they develop that interest right from that grade, maybe that could help.*

Learning environment
(include safe, inclusive, collegial, nurturing, supportive, provides a sense of belonging)

Pre-program survey quotations
- *Yes [strategy #4 can motivate girls] if you have created a "safe space" where kids know that they are free to make mistakes. If not, freedom to choose their own direction can sometimes be a disincentive.*

Post-program survey quotations
- *[We practiced strategy #5] constantly during Parachute Parade. Encouraging students on how to change one variable and not give up. Praise the way they moved through the engineering design process … students really fed off this strategy. But it took a ton of energy with 20 students and not enough other staff offering the same support. This strategy is super important.*
- *Giving the girls the smallest feedback, it made them work harder and it boosted their confidence!*
- *… we also had a SciGirls Shout-Out kudos jar, where the girls (and we) could write words of encouragement and praise. The girls loved this idea and would rush to the bathroom (where the kudos jar lived) to write kind messages for their peers. We all enjoyed the public forum of reading these kudos at the end of the day before the girls' parents picked them up.*
- *I noticed when we were working on one of the projects, one of the girls turned to another and asked her what she thought of her project, the other told her it looked great and asked her to explain what she did, just the other classmate asking for an explanation made her light up and she just started explaining every detail.*
- *Giving them the choice of what they wanted to present and how they wanted to present [helped make] them comfortable.*
- *A couple of the very shy girls had more trouble and those with little English language also struggled a bit, though their friends were quick to translate when necessary. We incorporated Spanish into the group activity when possible. They became a cohesive group by the end of the program and were so excited about STEM that they want to continue the SciKids program.*
- *It might be good to add some social values like respect to which all should aspire. That would be respect toward instructors and mentors, respect for the materials and facilities which are supplied, and respect for each other as well as self-respect. We had to stress this often. Girls need to value themselves to develop the confidence needed to pursue professional goals. There are stories about how many girls have gone into computer work and some other fields but have not stayed in those field because of the harassment and disrespect toward them. Somehow, we need to prepare girls for this while at the same time teaching respect to both boys and girls so we have better work environments.*

Post-program interview quotations
- *The strategies are designed to make STEM learning approachable and impactful for all.*
- *Having us pay attention to [their work] … and giving them [positive feedback] really played a part in them making wanting to do SciGirls again, because it showed them that we cared and that we were really taking the time to see what they created, how they created it, and that we supported them.*
- *I think a lot of the activities, and definitely the way [our educator] facilitated was … everything going at the girls' own pace.*
- *One thing that really stood out to me, which I try to do [when I oversee our interns] … is how we speak to people. And one thing is [that we] don't say, "Wow you're so smart" or "Wow you are good at math," [but] instead say, "Wow when you did that problem you showed that you tried really hard." I liked that way of communicating and that way of supporting what young girls are doing, because I know with our kids we [would] say "Hey, you're super smart" because they got something right, but then the next time they have all this pressure to be smart again and it becomes this huge, perpetual thing. But if we point out exactly what they did correctly and how they utilized the skill, that will encourage them to keep going.*
- *One thing that I do think is a challenge is … we're running [a different SciGirls] program for a full school year … and I think it kind of keeps them in this program only … Students aren't leaving because they don't like it, they're leaving because they want to do something else … I think 20 weeks [would be] a perfect commitment.*

Collaboration
(include sense of group membership, highlighting communal & social aspects of STEM)

Pre-program survey quotations
- *The girls love to brainstorm together and solve problems as a team. All the girls take on certain roles that help them fit into the group and participate in their own way.*
- *This strategy has helped them in working together in small groups and allow them talk about their ideas and knowing that each girl's contribution[s] are valued.*
- *This strategy helps girls that struggle with collaboration and sharing ideas. For some girls, this takes practice - they feel like their voice is not heard and this strategy gives them the opportunity to share their ideas in a fair and non-competitive way.*
- *When there are groups who come together consistently it is more likely to succeed. When the programs do not have consistency of attendance there is less likelihood that the collaborative work is successful. The girls see their work as theirs alone …*
- *Sometimes … the girls feed off each other's enthusiasm. Sometimes I've seen more introverted girls who want to work alone and are less interested in any sort of collaboration.*

Post-program survey quotations
- *As they would eat lunch I would show a SciGirls episode that was related to our activity/theme for that day, and it helped them to understand what we just did or what we were about to do. They also showed the girls how you are able to meet new friends and have fun with your friends and learn at the same time.*
- *I think [strategy #1] worked when they liked their group or partner. It was difficult for the few times that girls didn't want to work together. It was a good opportunity for them to work on collaboration and learn to communicate fairly with others, but they weren't particularly pleased or energized about it, and because we only work with the girls for one week, it can be challenging, since they don't have the time to really develop relationships with all the other girls in camp.*
- *Half the time they enjoyed [collaborating] - They either did not like their partner or did communicate fairly. This was one drawback which bred behavior issues that were not completely addressed by partnering staff.*
- *The girls are very energized by this. I did notice some find it harder than others but I also noticed the 1 individual lesson we did I noticed the girls were still checking in and looking for feedback or wanted to discuss their idea to solve the problem with the girls sitting around them.*
- *I would maybe combine collaboration with one of the other SciGirls Seven rules.*
- *Collaboration was something we wanted to encourage, but it was also necessary due to constraints on time and resources.*
- *The girls who had similar interests joined groups and were able to share ideas, work through questions and come up with solutions. We did have to step in at times because they got so excited that they sometimes got off topic (as is expected.) We did [have] a few students that were not fans of this strategy. They struggled to work with others in their group and come to a consensus when they had disagreements. We were able to facilitate most of the time, but it was interesting to see how even though we think this is the best thing ever, it was not the case for some of the more introverted and independent students. It was still a good experience for them though.*
- *Team work can be challenging. The normal school day does not encourage team work, so they often seem more comfortable working alone, but we encouraged group cooperation and they became more comfortable as we progressed through the program. We did have them sit in groups to encourage communication with each other.*

Post-program interview quotations
- *Something that really sticks out to me that I see them most comfortable with getting engaged is … the collaboration piece … even when we gave them the opportunity to work by themselves, they still were seeking each other out to ask for feedback on what they were doing …*
- *I think something our educators maybe struggled with was how to deal with interpersonal relationships with girls, because I think there was a lot of … not arguing … but a lot of things that ended up being not as constructive as they could have been, that ended up leaving some girls feeling worse, like their ideas weren't being appreciated by the other girls as much. With kids, you see that as a normal part of their social development, how they banter with each other, but I think it would be great to have a way of facilitating that with girls that maybe helps to make that process more constructive, like maybe specifically set some ground rules for discussion that make it more fair, so the girls feel like they're getting their voices heard more, and then the other girls [learn] how to engage in dialogue without feeling like you're arguing or getting really personally emotional, like keeping an open-mind and seeing each other's perspective … so, how to engage in constructive dialogue … I think that sometimes girls can feel picked on, and maybe if you don't have a very good self-image or a lot of confidence to begin with, it's easier for them to feel picked on if there aren't more things in place to structure the dialogue.*
- *Our first [session], when we started, we talked about the seven strategies and how each could help them. And I feel it had a great impact because, at the end of the program, while discussing their experiences and what they had learned in the program, they were able to share that [collaboration] was one of the strategies that actually helped them.*
- *One of the most important strategies that I've used is group work, the idea of teams. Working with groups encourages that teamwork idea and it allows them to collaborate with each other, so when they're in groups they're able to bounce ideas off each another, and that collaboration is learning with people your own age, so it's a lot less of teachers lecturing at the front and a lot more being engaged and having to actually apply what you already know with the new information that's been presented.*

- *I think that collaborative approach, where girls kind of talk to each other and talk through things, has been really useful because they bounce ideas off each other and usually – if it is a girl-only program – … I think they're able to be more open and talk through their thoughts. And of course that varies with learning style, but I think that's a big one.*
- *I think that [teamwork and allowing them to pick their own tasks] worked really well together because … sometimes we had projects where they were working in teams [and half of the class worked on one aspect of the project while the other half worked on the other aspect, and then we would have them present on what they did]. It was kind of based off interest, so that kept each side engaged, and because we had two teachers, we were able to do that … [And another thing I liked about this was], maybe one group wasn't so interested in a certain part of the project, but they were still getting educated on it, so they got to do the part that they preferred, but everybody learned. I think that presentation aspect of it helped the girls gain a little confidence, there was a little sense of pride from the work that they had done. I think that's really important in learning.*
- *As they worked together on things that are hands-on … they start thinking as a group, so they start communicating … and I had the girls work with different partners in different groups, they didn't always have the same person or group of people that they were working with. So they kind of had to learn how to communicate with the other girls and feel comfortable around them, so they would start asking questions [to do the activities] … It just helped them feel confident … and feel confident with other girls, because I know, especially at this stage of middle school … it's kind of cliquish.*
- *I think the collaboration piece is a little bit redundant, but it's important. It's so hard because I feel like there's a spectrum of STEM educators. Like, when I train other educators, they don't know it, but I feel like #1 is a little bit of a duh strategy, at least for me. I know girls benefit from collaboration. I feel like if they are going to have it, it needs to go a little bit deeper, like a more real-world sense of collaboration, what does collaboration look like in a work place and then how can we bring that to learning opportunities?*
- *We had, I think two girls, that had some pretty strong social issues, issues interacting with people, they were homeschooled, they hadn't been exposed to it … for them coming in to do science, they weren't super jazzed about it, and having to do science with 23 other girls … But I think having the collaboration take place in the framework of "we're going to work on a project together" as opposed to … "we're going to make you talk about yourself," I think that was great … it got them excited because they had other girls that were excited in their group, those kind of forerunners in STEM, and so they were able to share their excitement.*
- *I do think that … the teamwork issue … they're so used to doing individual work in school that it's a little bit hard to switch gears and work in teams … [Also], that communication for the younger kids is really hard. They just see it as, they want to produce their own little thing … so it takes extra work … to get to that point … a little more encouragement and supervision sometimes.*

Hands-on, open-ended activities
(emphasize open-ended projects/activities and include approaching projects in their own way, allow exploration, encourage individuality & critical thinking)

Pre-program survey quotations
- *I have seen girls want to work all day on one hands-on investigation trying to make their design better after each [test].*
- *They test their materials, visit the materials table, and continue with the engineering process. They get to be challenged, but comment that it is a good way to be challenged.*
- *When there is no one "right way" they get excited to try and test and play and create and redesign.*
- *… [this strategy is the] easiest to implement …*
- *Open-ended projects are tough too because of time constraint, material constraint and training of teachers to be able to do this successfully.*
- *They enjoy participating, however many of them appear to be frustrated by the fact that there is no "right" answer.*
- *Some of the girls like to help the other girls to complete the project but on the other hand some girls don't enjoy this because they are shy and don't want to open up and work with others.*

Post-program survey quotations
- *The hands-on activities always have the greatest impact, especially as we have our volunteers/mentors/role models engage with them throughout the activities.*
- *A co-teacher I was working with did not like the idea on having open-ended projects mostly due to behavior issues that can arise from that. I pushed back that we would allow them to do the activities their own way and I believe that really pushed students to think critically. For some students, this was very uncomfortable and some did have melt downs and didn't want to participate because they couldn't get to a "right" answer or conclusion. Using [strategy #5], I could keep those students focused and on task- but it took A LOT of work. I would want a longer training on the use of the SciGirls Seven [for the other educators in the program] if doing this program again with this type of summer program.*
- *We really wanted to make the activities open-ended and give the girls choice about how to approach each activity. We wanted to make sure it was their ideas they were getting to follow and explore.*
- *Almost all of the projects we did were hands-on. We made sure that we didn't box them into directions and so when girls would ask, "Should it be like this?" we would respond, "That's up to you and your interpretation." Sometimes the girls would get a little frustrated because they wanted an answer but once they realized the freedom it gave them, that changed.*
- *In terms of the open-ended projects, we really try to be intentional about how we select what projects they're going to be doing and what materials they're going to be using, especially … we'll get a lesson, [we SciGirls it up and we'll select articles, videos, etc.] to reinforce the idea of why what they're doing is impactful … Having so many touchpoints … about the same activity helped them be more confident in "This is why I designed it, here's how I designed it," … so they can be really confident in sharing their learnings and outcomes and their product with each other.*

- *The girls were constantly asking questions and collaborating with one another on how to perfect their projects.*
- *Each activity had various challenges that required them to brainstorm, help each other, and figure things out … and we had to do lots of encouragement to keep them problem solving and working towards the end goal … they felt empowered to figure things out and we could see them using these same techniques with their families when they challenged them to the dough creature activity.*
- *There is value in guided procedure, to show scientific process and the reason why it is done a certain way. That does not mean the students cannot experiment with other methods or process, but it is OK to give some structure to create authentic experiences.*
- *I'd recommend including how-to videos for facilitators; this would make it easier to better present the activity to the group.*

Post-program interview quotations
- *… We also look at the other activities we're going to use and see how we can incorporate the SciGirls Seven into those. [This summer, we focused on making things open-ended so girls could approach whatever the goal was from their own experience.]*
- *The use of open-ended projects helps decrease competitive aspects of [the] activities, it's not about winning so much, or coming to the best solution, but coming at a solution from your own experience that incorporates your own interest … [Also] restructuring activities to take out the competitive components … [when working with groups of boys and girls] I've seen girls really shut down by activities that … encourage competition, and I've seen some of the male students get really into the competitive aspects, that's a real motivator for them, I've seen the girls have that be something that makes them less interested.*
- *… Any open-ended, project-based activity, our girls could have gone all day, all week with. So I felt like they found those project-based [activities], where they could be creative and answer in their own way, I feel like they're drawn to those type of lessons the most and excel the most with that type of learning … The hands-on strategy … I feel like that one could be elaborated on, like not just hands-on, because I feel like hands-on is so common nowadays. (KW note: Then s/he read from the SciGirls Seven guide to share more about how this could be elaborated on.) Exploration, imagination, invention … that's exactly what I was going to say … creativity … and then that need and want to figure out the problem. But it basically says that.*
- *I think the goal of [the strategies] is, as educators, to be better communicators and better leaders. I know that they make teachers uncomfortable, especially the open-ended projects, they really want to have a lot of control over how the kids do that, especially in a prescribed time frame … even over the summer, because of behavior issues, I ran into a lot of pushback from my teacher … [and I have a feeling that] once I stepped back for the rest of the summer, that SciGirls Seven was no longer used … The goal of them I think is to really communicate with students in a more holistic way, giving them more opportunity to actually go through a process or go through an activity, they get so much more out of that activity – and then leave with, maybe not an understanding of everything, but [if you implemented all seven strategies] they would be able to identify an activity with a person, and that's going to leave an impression. They're going to have some kind of hands-on [experience] … that's going to leave an impression on them. And someone is going to have given them some positive feedback on their project … I feel like those three things are going to be [most lasting] from a student project. I think it's a very strong engagement and teaching model … [Although for some educators] there's that fear of the unknown, and I feel like that can be crippling to an education experience.*
- *We always did hands-on activities. That's what makes our program different from kids being in school … they need to see that there are other ways to approach things than what they do in school … so it's important to make that a different experience … But where you're blending it is with … you're not just doing hands-on activities by yourself, for yourself, but with a group … you require multiple kids to do certain projects … [and as you use those two strategies together], they are obviously things that are relevant … to what [students'] thoughts and preferences are … so I don't know how you could separate [the strategies] … I think they stand better together.*
- *I feel like maybe you could do the personally relevant projects and open-ended projects in the same strategy, because I also think they go hand-in-hand … Maybe I'm saying that because I feel the most comfortable with those though.*
- *I believe I had also made note of trying to incorporate maybe some sort of a [field] trip regarding the SciGirls. Even if it's not pertaining to a specific activity but just [something] in the STEM field, because as much as we can give them a real-world experience, it makes it more relatable to them, it seems more down to earth to them … As much as we can make it more[relatable], it makes it less, "Oh, this is science, I'm never going to use it" – it makes it very fun for them. [The field trip idea] drives home the fact that it's real world … and they see teams of people … so I think that would be a great opportunity to take that hands-on up a notch.*
- *I think the one thing … about science is that procedure is important. When you're doing chemistry, for example, you don't just put out a bunch of stuff and say, "Do what you want with it!" There are just things you have to have, you have to provide rules and procedures of how you use things and why and all of this … There has to be some kind of foundation or basis first, that they work from, and then, once they have a knowledge of the materials, of what it is you're seeking to do at that particular time, then they can have some freedom to experiment with that … You can't just start from nothing, or it would end with chaos, and nobody learns anything from that.*

Pre-program survey quotations

- *... many [girls] express that they now consider careers they may not have prior to mentor experience.*
- *... when the girls can see other women that look like them doing the things that they dream of doing, it most definitely inspires them in a way that can't be done through just an activity ... it puts a real face to something that they would like to accomplish.*
- *We have had more difficulty finding mentors who represent the ethnicity of the groups we work with and who are available at times when we meet with students. When we put out requests for mentors we hear from a mainstream group of individuals ... We just would prefer to balance it more ethnically.*
- *It's very hard for the settings we work with to incorporate STEM professionals and often times we don't have the technology for digital showings of STEM professionals at work.*
- *Students participate in a Career Awareness seminar where they get to ask questions to the presenter, but do not have an opportunity to build a relationship with them.*
- *We have had limited exposure to mentors in our afterschool programs. Mentors have been involved more in our special events and workshops. I have found that in the underserved communities we serve, the students seem most inspired by the ones who really show they care for them and consistently come to them. Many people come and go, but the students don't develop much identity with them. These young people are often lacking in strong relationships and many have experienced abandonment. When they know you are there to stay and you truly care about them they respect and appreciate what you bring all the more.*

Post-program survey quotations

- *I had time to conduct an oral interview with the girls in the program. They indicated they really enjoyed talking to the role models and learning what they did. They were surprised that the ecology jobs existed and were interested in them.*
- *[The girls] asked great questions to the role models and continued to speak about them days after they were part of the program.*
- *The women they met in STEM careers seemed to have one of the greatest impacts on them. They were able to see girls/women who looked like them, who had a lot of the same interests as them doing STEM in their day to day jobs.*
- *The kids were very interested in the role models ... we visited a community farm where [the farmer] showed the girls around. Some of the girls were nervous about the chickens or drinking out of a hose or eating vegetable straight out of the field. When they saw [the farmer] doing these things though they went right along with it and seemed to embrace trying things her way.*
- *Youth were in awe of the role models. They were respectful, asked great questions and engaged. Students came up with their own questions based on what the role models were saying such as "Why should I participate in an internship?" and "How did you get where you are today?"*
- *They girls seemed very interested in their personal lives and intrigued by their professional lives. They were eager to ask questions to get a better understanding of their job and how their lives may be similar to one another.*
- *I definitely saw some inspiration because after talking to their role model each day they became more and more motivated and confident in the STEM activities.*
- *The girls get the most out of the mentors we have come in and speak and work with the girls. They are able to see what they are learning in class and how it applies to a future profession. They are always very interested in what the women do and it opens up their options of working in a field they enjoy.*
- *Continued focus on role models - especially ones that look like the girls makes a huge difference. Having a diverse pool of role models is so important.*
- *They loved engaging with our college students and asked lots of questions of our volunteers who came in for panels. They really enjoyed having the role models engage with them on the SciGirls activities. For example, two of our role models joined in with a couple teams on their hands-on activity projects ... They gave the role models roles on their teams and got the role models having just as much fun with the activity as they were having.*
- *The role models gave our students hope for their own futures. There were several situations where some of our students felt like they were not smart enough to pursue STEM but one of their mentors encouraged them to be persistent and push through any failing situations. "The only shame in failing is when you do nothing about failing." There was also a situation where a student was only interested in fashion/design and did not see the relevancy of STEM. Her mentor help her to find the math, science, and engineering in that field. The mentor also guided the student in reviewing the college course work involved in that field of study.*
- *The youth loved the role models ... What I liked about [one role model's] presentation is that she added the element of family, making it personable, and also allowed the students to reflect on their families and how support of STEM interests at a young age can lead to careers in STEM. As a young Latina, [she] was an excellent mentor and role model for our Latino female group. She truly embodied that idea of female minorities in STEM, which led to a very engaged classroom!*
- *I mentioned this previously, but we did try to find mentors of Hispanic heritage, so the Latina students could identify with them. Not all were Latina, but it was enough to show them that there were successful Latina women who looked like them in professional STEM jobs. They were excited about all the mentors but this connection of ethnicity was important.*
- *The girls were excited each [session] to meet the role models and ask them questions. I took a peek at the post surveys just to see what their feedback was and many of them mentioned pursuing careers in fields that the role models shared with them. We also got some great feedback from parents on our group Facebook page after the program, [such as]: "Thank you ladies! This was such a great opportunity for these girls. TY for being amazing role models and powerful, strong, intelligent women!" and "Thank you so much for inspiring the girls each month. Your enthusiasm and passion for what you do was definitely noticed! My daughter has an*

even deeper passion to continue following her dream of working as a scientist with amazing ladies like you. Thank you for everything you do. I couldn't ask for better role models."

- *This strategy definitely helped to motivate the girls to see STEM in a different light. Questions that related career to life experiences and the expectations for the girls were free flowing.*
- *We do our role models in a whole group setting, so 80 girls listening to the role model at a time, 3 days a week. Our youngest girls (Grades K-4) have high engagement with the role models however the older students aren't as engaged. I don't know if it's because of the large group setting or if we don't do a good enough job preloading the girls with information about the role model but there is a gap there. The videos we show are impactful to a certain extent but the role models feel far away and there is no personal connection so the older girls aren't as interested either.*
- *We tried to get female role models when possible, but we had the opportunity to have a couple of outstanding male mentors as well. I did have parent feedback that they wanted the program to have both male and female participants and role models because that reflected the real world better than an all-girl program. (KW note: Most of the youth in this educator's program were girls.)*
- *It was hard to get mentors into the classroom to lead activities in STEM careers.*
- *Though we did have several role models for the girls to interact with, I wish we had incorporated the role models into activities that they could participate in with the girls.*
- *I would have liked to have more role models and mentors involved. We did have several special guests, and the educators participating in the camp were good role models, but I would have liked to bring in more female scientists.*
- *I would suggest including a strategy that would allow participants to visit on-site science locations that relate back to the specific activity; I think this would take the science experiment to another level by exposing youth to what the science field is really like; it would give the participants an opportunity to meet role models & mentors in their own environment, and [see] what it is truly like to work in that specific field.*

Post-program interview quotations

- *… role models, role models are huge … if you've never met a scientist you can't imagine being a scientist because you don't know what they do or what they look like … Even if it's just a small connection, it really does help to inspire kids.*
- *Continued focus on diverse role models, especially ones who look like the girls.*
- *[There is a need for strong relationships between the girls and between the girls and the educators or role models, and it's important to make sure girls have a chance to engage with role models they identify with.] That's been a big part of my journey as a woman in STEM.*
- *The role model piece is huge … I feel like we do that really well, we work with a lot of companies and engage their employees, and … we get a contact and then we have them be a [role model], which is how we start all of [our sessions], and then from there we usually plan an expedition, which is a field trip to their work place, that opens the door for hundreds more [role models] … and then … I think [these field trips have] been a game-changer too because … kids are always wondering why they have to learn what they're learning, or they don't really know what the real-life application is and a lot of science is really abstract, you kind of … put your hands on it, so going to a workplace and a company to see what exactly that means is really beneficial for them.*
- *We had one mentor [who] really shined out … they ended up asking her what was her process to becoming an engineer, as far as school, even her childhood, [and] she told us childhood stories of how she was the little engineer in her house, and how she took that interest and built it in high school, and took it to the next step in college, and now it's her career. I think that was great because her, along with the other mentors, they kind of hammered in the idea of, you want to take an interest that you already have, and use that and apply that in a STEM career. Use that as you choose a career in the future. I think that was really important.*
- *In my experience the most effective strategy has just been having female role models show the girls exactly what is possible in their professions, and usually, whoever the role model is … is excited about what they're doing, [so] sharing that with the girls in a very hands-on way has been the most effective I would say. But a really close second to that would be … really making it relevant to the girls, in whatever context that may be, whether it be age-appropriate or culturally appropriate … so what we try to do … is have a variety of cultural backgrounds represented in our mentors to just show that it's not just one specific type of woman that can be successful in these fields.*
- *I think having the role models was a great effort … Having the role models and exposing girls even to pictures of women in science … seeing themselves as scientists. Because we initially said to the girls, what does a scientist look like, not one girl said a woman. "Man in a white coat" was their reference point … And then seeing [their] videos at the end was really encouraging because they spoke of themselves as scientists … If nothing else … this is what I wanted to come out of this program.*
- *By bringing in the different mentors, that's really an important part, because they see that women and men are involved in so many different aspects of STEM that they never knew existed. Not everybody is working in a laboratory … there were varying degrees of interest in the mentors but it had to do with the girls' preferences, so if you only expose them to one aspect of science then they might think, "Oh that's not for me." But as soon as you show them there are many different options, they see themselves in some part of it. And so, I think the diversity of what we use to teach them about STEM is important.*
- *I think when there's a female saying to their young female daughter or granddaughter that they want them to do [SciGirls], I think that's a really positive role model in itself, that another woman is telling them to do it.*
- *With our mentors … one of the important things we focused on was establishing a relationship with students … [we had someone new every week] … [and we would have the mentors ask questions and play a little game with the students, like "Guess where I work?"] … and there was a feedback between the [the mentors and the youth], and eventually they would find out and it would be great … And then [the mentors] would give us a little presentation about their work … and they would also come with a class project that was based off of their subject, and I think that part was really great because it was like having the resource right there in the classroom as we worked on that, and the kids took a lot away from that, again, asking questions … I saw lots of questions being asked, so obviously their interest was sparked … [The activity] was something that the mentors themselves brought it. And I feel like*

the fact that it was actually the project from the mentors is really what got the students like, "Wow, this is really what [this field] is." It was really related to whatever subject they came from.

- *What I noticed is that the girls were super excited to meet these women who were so successful in their fields … and it was really cool to have the girls chat with these scientists, but I noticed that after about 15 minutes, even though they were really excited in the beginning, they started to fade a little bit. So I felt, for next time, we would have a quick chat but then have the role model … be involved in some sort of activity that relates to the topic of the day [and also to their field] … it could be even a game … to be more involved with the girls on a hands-on, personal level then just [giving a talk and having the girls ask questions] … have that mentor be involved in something productive and useful that really solidifies the message but also, they just have the extra time with the girls to do something fun instead of just to talk.*

- *I'm at the stage where I want to really include … a stronger role model orientation within the training, as we move forward.*

<div style="border:1px solid #000; background-color:#c6d2e8; padding:10px; text-align:center;">

Cultural responsiveness

(examples include incorporating the culture, lived and social experiences of students; allow students to build trusting relationships; connecting activities with girls' real-world & cultural background; allowing for reflection & connectedness; encourage & embrace students' own communication styles and creativity; consider needs of students.)

</div>

Pre-program survey quotations

- *I like the idea of culturally responsiveness - in the sense that we [should] address it. But I struggle with how.*
- *Awareness that different cultural backgrounds may require variations in approach. E.g.: the Latino community seems to be somewhat hesitant to engage easily in community projects. There needs to be development of trust in these communities. The way they see their daughters will also affect their support. I have had issues with afterschool programs for Latino families who would not allow their daughters to be out after dark. In the north in the winter that can mean no afterschool program or the girls having to leave before the activities are completed. Not sure how to address this right now, but it may mean a different way to deliver programs.*

Post-program survey quotations

- *We offered materials in Spanish for those who may need them (although I don't think any used them) … Should we have had Spanish-speaking participants or families, this is an important way to make sure they are included … Something around cultural relevance would be good to include [in the SciGirls Seven] as a good reminder of how important this is to engage students … I don't think you need to add a cultural relevance strategy, but it could be incorporated into the role model and activity side of things … it could be part of the "how do you implement this strategy" side of things.*
- *The activities were engaging for families. The students were excited to demonstrate what they had been learning to their families, and working together on projects as a team embraced that sense of family, which is an important principle in the Latino community.*
- *I love the episodes … because it reminds the students that SciGirls all look and sound different, but anyone can do it.*
- *I believe we should use the term STEAM, not STEM for the SciGirls program. It does help in bringing girls into STEM activities to know that art and creative activity is part of the process … They are much more likely to engage initially if they know this.*

Post-program interview quotations

- *I think this speaks to what I said before about how [the strategies are] all fairly integrated with one another. It's hard to give that specific feedback, positive feedback, if they're not doing a hands-on activity … So if the culturally relevant piece is important, it's embedded throughout, it's not a stand-alone separate thing where you would check the box and say, "OK, we have a culturally relevant role model, we're done," because that's not … because is that really incorporating that important piece all the way throughout? (KW note: We asked for ideas of how to incorporate cultural relevancy into the programs "all the way throughout.") Some of the things like having those videos … where you have the different folks from different backgrounds, different cultures … to give some of that context. I also think about things like the Engineer Life campaign has a video of a native American women who is working on I think it's wind energy so the folks on the reservation where she grew up can have easy access to power … so tying those kinds of culturally relevant stories to … the Blowing in the Breeze activity with SciGirls … can make a difference. I think it's also helping educators understand how to adapt, modify, be creative with their activities – even SciGirls activities – to make it relevant to the community that they live in.*
- *… a lot of the groups we work with … [are from neighborhoods where they're not exposed to any sort of science in this way], so somehow incorporating what's going on in their community, whatever that may be, would be a huge step in sort of making them feel part of something that can actually happen.*
- *In addition to the research project which was girl-driven, we also had the girls keep journals throughout the program. This was their tool to use as they wanted. They decorated them on the first day to make them their own unique journals and they had them at every meeting. They could take notes, collect data, draw pictures, write notes/thoughts. The idea was for them to record their experience in SciGirls in whatever way was meaningful for them.*
- *Incorporating the STEAM in STEM … has also been a big tool for me in being able to talk to girls about things they might think are gross … like anatomy … and being able to do it in an artsy way. The "sparkle, sparkle" is the key to everything. Using art as a sort of vessel to teach science to girls especially, I find that to be a really effective tool because they can approach the subject and then after they're in it, they don't mind the yucky so much because they've already seen it in a less intimidating way.*

- *We call it STEAM … because we bring the art in also … and I do think it's very important for girls, because there are a lot more girls that seem to relate to the art and creative aspects than to the STEM, originally, so when they know it's STEAM it perks their interest and they want to be more involved, and then use the creativity … because I think it's integral to doing science, that creative aspect is what science is all about. It isn't learning just rote memorization of information, it's creating new ideas all the time, and I constantly reinforce that with kids.*

<div style="text-align:center; border:1px solid #000; background-color:#c5cee0; padding:10px;">

Growth mindset
(include celebrating the struggle and teaching that failing is okay/part of the learning process,
focus on process more than results, giving positive, process-oriented feedback;
learning is iterative and all progress is good)

</div>

Pre-program survey quotations
- *We use Carol Dweck's Mindset recommendations … Girls need to know that the effort they put in will work to their benefit.*
- *I have used fostering a growth mindset strategies with girls - encouraging them to keep positive and have an open mind to content and to each other … This is important because they will need to learn how to adapt to changes in their lives and doing so with a positive "can do" attitude will make the world of difference to many of the kids I work with. They need to learn how to make a terrible situation into a positive one or what can they take away from that situation to make things better in the long run … It builds on the foundation of the SciGirls, so maybe just adding or tweaking the wording would incorporate it.*

Post-program interview quotations
- *I really love all of the SciGirls Seven, but I've been thinking about it this year and I really think growth mindset could be more explicit.*
- *Building off … growth mindset [from earlier in the interview] and … the importance of "If you believe you can do something, you can do it" – I think having a bigger focus on that, or weaving it in with a stronger presence, would be really helpful, and maybe that's a marketing thing … I think working with a demographic that's underserved, you can't stress that enough.*
- *[And another one that's embedded in the SciGirls Seven but not explicit is growth mindset.] I think that our educators … we tell them about growth mindset … and I think that that really does need to be explicit, and also teaching the girls about it. I have a daughter and when she says, "I can't do this" I say, "Well you can't yet but we're learning and sometimes it takes time." I think it would be nice to have that be a strategy … we did talk about growth mindset (with our youth), and I think with that, I do recall talking about when we're working hard, that's when we're learning. (KW note: We asked about the impact of telling the girls about growth mindset.) Other than that they just kind of agree with me … I haven't observed girls later saying, "Oh, we need to use our growth mindset" … I have noticed though in my own daughter, she'll say "Oh I can't do this!" and then she'll look at me and say " … yet!" I see in her an understanding of that, but I have more time teaching that to her.*
- *I think being explicit about the growth mindset and that resilience is so important. I think it's talked a lot in the booklet, I think there are tips about celebrating failure or celebrating the struggle, so I think it's within there, but if someone were only to read the postcard, maybe it wouldn't be clear enough about this growth mindset idea and the resilience we need to help girls and helps kids in general be persistent and not give up when they're struggling.*
- *I think the biggest strategy that I have used … is providing girls with feedback that they can control … Even just seeing the difference between working with kids 15 years ago and now, it's much more [about] instant gratification, they want the answer, if they can't do it they want to stop immediately, and "I don't get it, I'm not good at it." [Sometimes there's handholding] … Really just helping them think critically, but they really need a lot of attention with it. I find that the group recently required a lot of it, and it was good to be able to provide it because these are the kids that do need it, so I feel like that was impactful. But [I feel like one of the most important strategies] is really praising anyone for the things they can control, and then to encourage that failure is not failure … it's not about the end product … I think the inquiry gets lost in that. I think … focusing on those things make a huge impact … because it allows [space] for people and kids to fail, to make mistakes … and to get back on track … and to have a sense of accomplishment once they're able to get there … I would definitely keep [strategy #5], I really feel like that's one of the strongest ones … I don't know if there's a way to fine-tune or add [a focus on] the process, it's not about end product, and how do you navigate somebody through an inquiry process without frustrating them and losing them, and encouraging them, and really getting them to understand that it is about the process. [We also use Carol Dweck's work.] I think she has interesting stuff on that, on the process … fixed mindset vs growth mindset.*
- *[In terms of the SciGirls Seven], I would try to add … positive feedback or maybe constructive and positive feedback, for growth mindset … establishing a growth mindset is more important than anything. This way, if you have that growth mindset … if you don't make that mark that you intended, at least you know that this way you're going to pull yourself up by your bootstraps and keep moving forward and finding new collaborations, finding those individuals who can help and support you. We really don't want students feeling like they're alone.*
- *Working together goes really closely with the growth mindset, strategy 5. In order to be confident, I feel like you need that intrinsic confidence as well as extrinsic confidence, so when they're working in groups and they're hitting their stride, not only do they feel it but their group members recognize it as well, and so they get that positive feedback from each other and they're working together to make this bigger impact.*
- *I think if you give feedback on certain things … I think critical thinking is one of the things students struggle with in general, girls and boys, [because of the standardization of our education system]. And so not having a right answer or a direct answer can be challenging for them, and not doing it right or not getting the outputs they expected … so, with lots of positive feedback like, "Yes, but what approach are you going to take?" or "How did that work? Did you learn something even though it didn't work the way you*

thought?" I think being able to give positive feedback on the steps in the critical thinking process are vital, and I think … you can give positive feedback on lots of things, but that's where I see it being the most [effective], in getting them to not be afraid to come up with a random answer or do something that might not work, but it's okay because you're still going to learn. I think that feedback really is integral in increasing their capacity to think critically and to want to do it more.

- For the girls to see the activities – hands-on, real-world – and help them to learn, not only about the specific activity they're doing, but also … STEM activities in general and how it's definitely a learning process in how they come to their own conclusions on things … I think it gives each girl, and each participant, a real path in the learning of STEM activities and how [there aren't really wrong answers] and how you might come up with a solution at the end that you weren't expecting … it really helps them to do some critical thinking, at their own pace.
- [The SciGirls Seven allow you] to make sure you're designing in a way that the students are going to learn best, and not in a way necessarily that will be easiest to teach. And that can be challenging … because sometimes you want to be like, "Here are the instructions, do the project, tell me what you get," and not a lot of learning happens that way. Whereas when you apply it in the way that students are going to learn the most, even if they don't get the "right" answer, they're going to gain something out of each activity or experience you're giving them.

<div style="border:1px solid #000; background-color:#c6d3e8; text-align:center;">

Gender in STEM
(include explicitly discussing gender stereotypes, challenges for girls/women in STEM)

</div>

Pre-program survey quotations
- For our organization, the core strategy we have is an all-girl, safe environment. We serve only girls, so we focus on gender specific programming and culturally responsive to all girls. We stand firmly in the proven strategy of gender specific programming, its benefits and impact on the girls' futures … This strategy is researched and proven … I think the strategies are certainly similar, however, SciGirls programming is offered to all children in different environments.
- Is there a way to include explicit language and gender equitable teaching strategy language for educators? Like making sure they are clear to all about why we are focusing on girls. I guess more advocacy and updated language and research about women in STEM fields and more historical references available about the history of women in STEM.
- My only suggestion is to create/offer programming for younger ages as well. We find that by working with girls in pre-school, we can set the path for them to explore as they grow. By exposing girls to STEM programming at these very young ages (safely of course), we believe it opens their minds to options, promotes critical thinking and inspires them to grow with STEM as a core component of learning.
- Have updated information to share- has the needle moved at all in the past 7 years? Where are national numbers now?

Post-program interview quotations
- [The overall goal of the SciGirls Seven is] to create equity in STEM engagement, to disrupt that pattern of thought that we've always had about what we thought STEM education should be, because what STEM education should be has always been what engaged boys, and to change that and make it equitable, we have to think about ways that engages all.
- I think the seven strategies do a great job of reflecting the overall strategies of STEM education, and I think that's the case because they are research-based and they are best-practices. Here, they're laid out specifically for girls, but I think these are important strategies for everyone. They're particularly important with girls but I think they apply all the time.
- [Engaging girls in STEM captures it perfectly] … I think, even more than that, it's strategies for engaging all.
- I think that's what we're trying to do … that's broad enough that no matter what your program is, whether it's male, female … I mean, I will say a lot times what we say when we're presenting this, so that we get the educators who are reaching boys also, is we say "strategies to engage girls and all kids in STEM" because these are best practices for all, not just girls, even though they do in particular help the girls.
- When I first met the girls, I showed them the chart of how women are distributed in the STEM field and they were shocked … just getting them thinking about that, that all of these fields are out there and women aren't in these fields.
- [When we started, I asked them if they thought women could be in the science fields], and some of them didn't really think that they could have, so I think … they realized that they could pursue this kind of field.
- I really like how SciGirls says they're girl-focused but everyone can participate, so just because you're doing a collaborative project it doesn't mean it's better for girls than for boys, it just levels the playing field.
- We told the students that we were going to have a SciGirls week, and we explained [the program] to them, so the boys weren't super upset that it was called SciGirls … and we tweaked the name to … the mascot of our school … which was helpful.
- I think [the strategies] work both for boys and girls. I don't see them as being gender-specific, but I think what's important is that we always make sure girls are part of this, that they don't get sidelined, which can happen in a mixed group.

**Additional help or guidance educators may find useful
in their work to implement the *SciGirls Seven***

Post-program interview quotations

- *I think when we had our parent meeting, the fact that the parents were excited that the girls were going to have an opportunity to participate in this program, because we kind of selected the girls [based on who could stay after school.] We invited all girls, but then the girls who could stay after were really excited about the programming. And I think because it was free afterschool programming, our parents were really excited as well. Just having them think about their girls as scientists, it was amazing to me … The one thing I did want to add, about the parental factor. That's not something I did [in my previous position], but doing it here was an ah-ha moment for us … including the parents from the initial piece of the program, and telling them that their daughters were selected, and making them an initial piece of the program – one thing that I know happened here that didn't happen in [previous programs I've been involved with] is that we were able to keep our attendance up, so the parents felt like their children were really special in the program. [They were included in the beginning of the program, at the end of the program, and we talked to them when they picked up the girls – it was great.] I think it changed a lot of parents' perspective as well. We had a dinner in the beginning to get the parents there, that's part of what we used our money for, and we sat with the parents and the children. The wrap up was getting them to be able to see the girls do their videos … But it was very interesting … again, we're an urban district, we don't have a lot of parents I think that thought of themselves or their girls as scientists … so we were not only changing the scholars' perspectives, we were changing their parents' perspectives as well. The change was just phenomenal.*
- *The way that I've gotten the most involvement, to get girls signed up for programming, is I contact the parent first. And that's been really helpful because then I can explain to the parent what the program's all about, then give the information to the children, and then the parent's already aware of the program and it also encourages their daughters or granddaughter … to go forth with the program … And actually I got really positive emails back from the parents … and phone calls … and they just keep saying, "Oh my gosh, I'm so glad you have a program like this, my daughter needs something like this." Because I don't think the students can come forth and say, "I want to be more science-invested!" – especially at the middle school level. So, the parents know what their children want, and also what the parents want for their children, so that's been really helpful.*
- *The [girls] who actually stayed the whole time had parents who came to the parent night. The ones who weren't able to get their parents to come, they didn't seem to stay with the program.*
- *I believe that engaging the girls in STEM is the main goal … But I feel also that … if we want to engage them in STEM, we want it to [include] … a little more innovative … so while the hands-on is fun and engaging and it's real-time, I would always have something innovative, like I would be connected to the top tech agencies and communicating with them the type of things that they need for the industry. So, innovation, incorporating computer sciences and coding and things of that nature … While the other strategies, collaboration, communication, those soft skills are very important, the children that we are working with today, they want to know, like, "How is this going to help me? How is this going to impact my life, my ability to take care of myself, take care of a family?" I feel like when students are already in the innovative process, then they can see the relevance.*
- *That's the only other thing that I don't really see in the program, is more of coding, you know?*
- *Looking at ways in which to strengthen and support the training around the SciGirls Seven is always going to be an important aspect for me, as a trainer. And … to fully talk about the two styles of implicit and explicit teaching strategies … I'm really into studying what motivates adult teachers … and so I feel like, I'm going to forever want to keep my trainings robust … and keep my educators motivated and always thinking about it, so they don't move on to something else.*
- *I almost feel like there needs to be more education on specific parts of the SciGirls Seven, so … there are role model guides and the training and everything … but it wasn't until this very last time that I went to [TPT], when they were like, "The most important thing a role model can do is talk about her struggle" I was like, oh my God, we have not been doing that at all … a lot more information on how to make it beneficial [would be helpful].*
- *Because I've always embraced collaboration, we've always used positive feedback … and it reminds me a lot of the Nurtured Heart approach. That's one teaching area … that uses that same active listening, positive feedback approach, embracing unique learning styles, engaging in full collaboration, [and] making it an inclusive process for all kids …*
- *After a set period of time … How do we keep them [engaged]? Do we do the same activities? Do we watch the same videos?*