



Formative evaluation report

Educators' initial responses to the draft updated *SciGirls Strategies*

(*SciGirls CONNECT2* Phase 2)

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Significant findings

The independent evaluation firm Knight Williams, Inc. administered an online survey to educators from 16 *SciGirls CONNECT*² partner organizations to gather information about their anticipated use of, reflections on, and recommendations relating to the draft updated *SciGirls Strategies*. The evaluation aimed for two educators from each partner organization – specifically the program leader and one educator who was familiar with the original *SciGirls Seven* strategies – to complete the survey about the draft updated strategies after they were shared by TPT in March 2018 via an online webinar and a six-page document titled *SciGirls Strategies and Tips*. In all, 28 educators completed the survey, for a response rate of 88%. Twelve of the 16 partner organizations submitted two surveys each, and four organizations submitted one survey each.

More than half of the educators self-identified as *SciGirls CONNECT*² 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 original *SciGirls Seven*, among the 16 educators for whom this information was available, half had used the strategies for two to four years, while a quarter each had used the strategies for five to eight years or for a year or less. Key findings that emerged regarding the full group of 28 educators' anticipated use of and reflections on the draft updated *SciGirls Strategies* are summarized below.

Perceived goal of the SciGirls Strategies: When asked to describe the overall goal of the *SciGirls Strategies*, nearly three-fifths of the educators focused on one or more aspects of girls' STEM identity, as defined by the project, including: increasing girls' interest in or motivation to pursue STEM careers, increasing their confidence, and/or increasing their interest in STEM topics. More than one-quarter of the educators said the strategies were intended to make STEM personal or meaningful, while about one-fifth thought they were meant to incorporate cultural responsiveness, among other responses.

Initial responses to the SciGirls Strategies as a whole: Overall, educators generally: liked the strategies; found them well organized, clear/easy to follow, and cohesive; felt the strategies met their expectations; thought the strategies would be easy to use; thought they would find it easy to shift their thinking from the mindset of the original *SciGirls Seven*; and thought they would recommend the strategies to other educators.

Most and least valuable aspects of the SciGirls Strategies: When asked what they perceived to be the most valuable aspects of the strategies for use in their educational settings, the largest groups of educators (between approximately one-fifth and one-third each) pointed to an aspect of Strategy #1 or Strategy #3, or praised the full set. In terms of the least valuable aspects of the strategies, the largest groups of educators (between one-fifth and one-quarter each) indicated they found nothing least valuable, declined to answer the question, or pointed to an aspect of Strategy #4.

How educators thought they would describe the framework for strategy development: Nearly all of the educators thought they could describe the framework and how it relates to the updated strategies to a colleague. When asked to describe what they would tell a colleague about the framework, the three main topics addressed in the March 2018 webinar and in TPT's *SciGirls Strategies and Tips* document – STEM identity, culturally responsive teaching, and the learning environment – were each mentioned by just over half of the educators, while nearly two-fifths of the group mentioned all three elements, with other responses being shared less often.

How well educators thought they understood aspects of the framework: Overall, educators thought they understood two aspects of the framework addressed in the March 2018 webinar and in TPT's *SciGirls Strategies and Tips* document – STEM identity and the learning environment – very well. They

also generally thought they understood the remaining two aspects – culturally responsive teaching and how the framework helps support the use of the draft updated strategies – fairly well.

Anticipated ease or difficulty of using aspects of the framework: In general, educators thought it would be moderately easy for them to focus on STEM identity, consider the learning environment, and utilize culturally responsive teaching strategies throughout their use of the updated strategies. The few educators who went on to share questions about the framework tended to focus on an aspect of culturally responsive teaching, such as asking for “*more specific ways to interweave culturally responsive [teaching] in all of the strategies.*”

Perceived value of the individual SciGirls Strategies: Overall, the educators generally thought they would find each strategy very to extremely valuable in their Year 2 programs.

Perceived clarity of and questions/comments about the individual SciGirls Strategies: Overall, the educators generally found each of the strategies very to extremely clear. At the same time, between one-third and two-fifths of the educators had questions or comments about Strategies #2, #4, and #6. Somewhat smaller groups had questions or comments about Strategies #1, #3, and #5.

Anticipated use and effectiveness of the SciGirls Strategies: Overall, the educators expected to use each strategy to a considerable extent or a great extent in their Year 2 programs. They also generally thought the strategies would be very effective in engaging girls from diverse racial/ethnic and socioeconomic backgrounds and in facilitating girls’ STEM identity, as defined by the project.

Anticipated barriers/challenges and concerns about using the SciGirls Strategies: When asked if they expected to face any barriers or challenges in using the draft updated strategies in their educational settings, no one issue stood out among the educators. A third declined to answer the question, while a fifth indicated they had no concerns. About a tenth each shared concerns about the transition to the updated strategies and/or an aspect of the programming elements, among other issues cited by smaller groups of educators. When asked if they had specific concerns about using the draft updated strategies while implementing existing *SciGirls* activities or media that were developed with the original *SciGirls Seven* in mind, two educators shared a response, with one asking, “*How do we incorporate the new into the old?*” and the other going somewhat off-topic to describe the limitations of their particular program in terms of storage space and computer access.

Sense of preparation and suggested support: The educators generally indicated that they felt very prepared to use the draft updated strategies in girls-only as well as mixed-gender settings. However, when asked if there was anything TPT might do or provide in order to help them feel more prepared to implement the *SciGirls Strategies*, about half of the educators shared a suggestion. A third recommended TPT provide additional tips and examples (including in the areas of working with mixed-gender groups, coordinating programs of different lengths, and incorporating culturally responsive teaching strategies), a tenth each suggested TPT facilitate connections between educators and/or provide additional trainings, and less than one-tenth requested new activities.

Suggested revisions, additions, and other recommendations to the SciGirls Strategies: Throughout their surveys, a few educators proposed various revisions to the *SciGirls Strategies*, specifically Strategies #2 through #5. A few educators suggested TPT make specific additions to the updated *SciGirls Strategies*, including one who proposed incorporating a focus on critical thinking, another who suggested incorporating language from the original *SciGirls Seven* into Strategy #2, and a third who suggested expanding Strategy #3 to include critical feedback. Finally, throughout their surveys, a number of educators shared other recommendations for the *SciGirls Strategies* or factors they thought the project team might want to keep in mind as they finalize the strategies. When sharing other recommendations, the educators commented on: Strategies #1, #2, and #4; the framework for strategy development; their interest in additional trainings or illustrations of the strategies in use; and how they might work with other educators to facilitate their transition to the updated strategies.

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 update the [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 outreach partner 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.

This report addresses the first deliverable above: "Evaluate educators' use and perceived effectiveness of the *SciGirls Seven* with diverse girls in informal STEM settings." Evaluating educators' experience with the original *SciGirls Seven* and the draft updated strategies has been (and will continue to be) an iterative process facilitated by an ongoing collaboration between TPT, the outreach partner organizations, and the evaluation team, as outlined below.

Role of the outreach partner organizations

A total of 16 informal STEM education outreach partner organizations committed to participating in *SciGirls CONNECT²* for the three-year grant period.¹ As a condition of participating, two educators from each partner organization were required to incorporate the original and draft updated strategies into their *SciGirls* outreach programs for girls, and to provide feedback on the strategies. In Year 1 (April-December 2017) they focused on the existing *SciGirls Seven* strategies and in Year 2 (April-December 2018) they focused on a draft version of the updated *SciGirls Strategies*.

Bridging the Year 1 and Year 2 programs, the partner educators were also required to attend a webinar in March 2018 presenting the draft updated strategies and to review an accompanying document provided by TPT, *SciGirls Strategies and Tips* (see Appendix 1). Image 1 on the next page shows a slide from the webinar that details the similarities and differences between the original *SciGirls Seven* and the draft updated *SciGirls Strategies*.

¹ Two partner organizations were unable to complete the Year 1 requirements and were thus replaced in early 2018 by two new partner organizations with experience with the *SciGirls Seven*. Educators from these new partners reviewed the March 2018 webinar and the *SciGirls Strategies and Tips* document before completing the formative evaluation survey about their anticipated use of and reflections on the draft updated *SciGirls Strategies*.

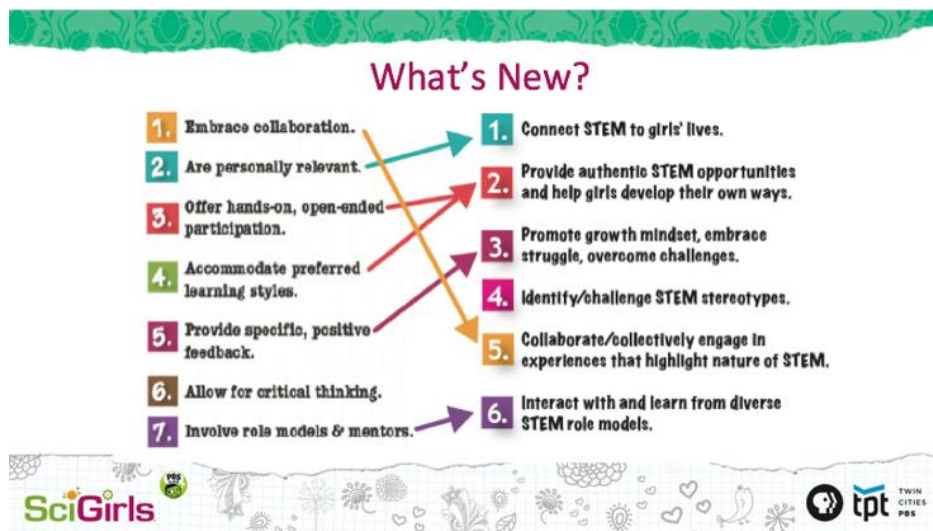
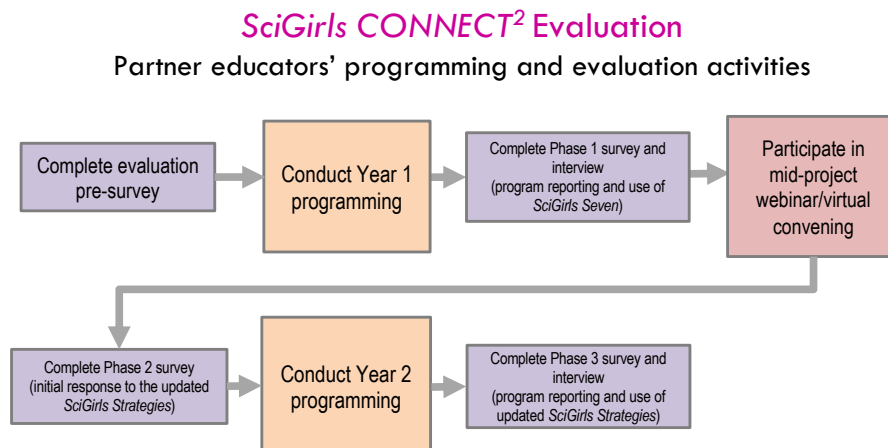


Image 1: Slide from the March 2018 webinar detailing the similarities and differences between the *SciGirls Seven* (on the left) and the draft updated *SciGirls Strategies* (on the right)

Role of independent evaluation

The role of the independent evaluation during the three-year project period 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 from Knight Williams, Inc. 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 shown below, educators are assisting in this effort by providing program information and feedback on their use of the original and draft updated strategies at four points over the two-year period through a series of online surveys, follow-up interviews, and program reporting.



This report focuses on Phase 2 of the formative evaluation, shown in the bottom left box of the flowchart on the previous page. The evaluation was conducted after the educators from the *SciGirls CONNECT*² partner organizations participated in the March 2018 webinar and reviewed the accompanying document, *SciGirls Strategies and Tips*, provided by TPT. The purpose of the evaluation was to gather information about the educators' anticipated use of, reflections on, and recommendations relating to the draft updated *SciGirls Strategies* to help inform the final version.

Method

The evaluation aimed for two educators from each partner organization – specifically the program leader and one educator who was familiar with the original *SciGirls Seven* – to provide feedback on the draft updated *SciGirls Strategies*. Knight Williams sent the educators an invitation to complete an [online survey](#) hosted on the firm's independent server two weeks after the March webinar presenting the draft updated strategies. The structure of the survey generally followed how the strategies were presented in the March 2018 webinar, moving from the strategies as a whole to the framework for strategy development to the individual strategies.

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-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

The evaluation aimed for two educators from each of the 16 partner organizations to complete the post-webinar formative survey, for a total of 32 educators. In all, 28 educators completed the survey, for a response rate of 88%. Twelve of the 16 partner organizations submitted two surveys each, and four organizations submitted one survey each.

Educators' location, role, and experience

Location

Image 2 shows the locations of the 16 partner organizations whose educators completed the formative survey about the draft updated *SciGirls Strategies*. The partner organizations were located in 12 different states across the United States and the District of Columbia, although half were based in East coast states (50%).

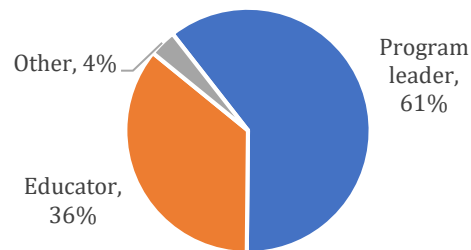


Image 2: Locations of partner organizations

Role at organizations

Figure 1 shows the educators' roles at their organizations.² The majority of educators identified as program leaders (61%). A smaller group said they were primarily educators (36%) and one described holding another role (4%), specifically *Outreach Coordinator*. In a few cases, the role of program leader seems to have been shared by two individuals from the same organization.

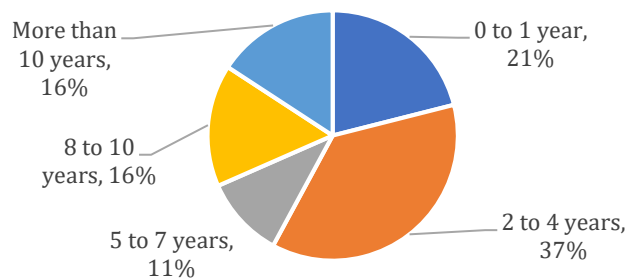
Figure 1. Educators' roles at their organizations (N=28)



Experience at organizations

Figure 2 shows the educators' years of experience at their organizations. For whom this information was available (19/28), the largest group had two to four years of experience (37%), while smaller groups had zero to one year (21%), five to seven years (11%), eight to ten years (16%), or more than ten years of experience (16%).

Figure 2. Educators' experience at their organizations (n=19)

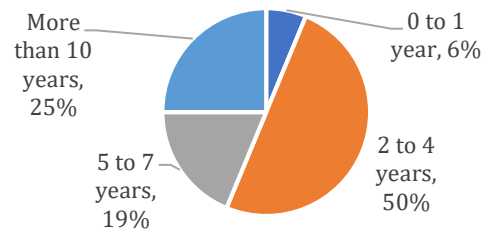


² In 20 cases, the educators who completed the survey were also those who had filled out the front-end survey and/or a formative survey and interview at the end of their Year 1 programs. Where relevant, information provided through either the front-end survey or Year 1 reporting is shared in this evaluation. For example, the numbers charted in Figure 2 are based on information provided by the educators in the spring of 2017, as part of the front-end evaluation, and the numbers charted in Figures 3 and 4 on the following page are based on information provided by the educators between August 2017 and January 2018, as part of the Year 1 post-program reporting.

Experience engaging girls in STEM

Figure 3 shows educators' years of experience engaging girls in STEM. For whom this information was available (16/28), the largest group had two to four years of experience (50%), while smaller groups had zero to one year (6%), five to seven years (19%), or more than ten years of experience engaging girls in STEM (25%).

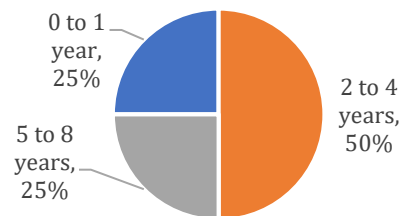
Figure 3. Educators' experience engaging girls in STEM (n=16)



Experience using the SciGirls Seven

Figure 4 shows educators' experience using the original *SciGirls Seven*. For whom this information was available (16/28), half had two to four years of experience (50%), while one-quarter each had zero to one year or five to eight years of experience (25% each). Nine of the remaining 12 educators were known or thought to have had previous experience with the *SciGirls Seven*.

Figure 4. Educators' experience with the *SciGirls Seven* (n=16)



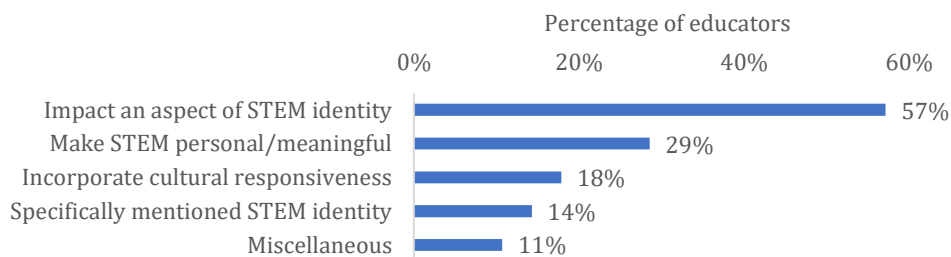
Findings

Part 1. Feedback on the *SciGirls Strategies* as a whole

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

Figure 5 shows what educators perceived to be the overall goal(s) of the draft updated strategies. Most frequently they focused on one or more aspects of fostering girls' STEM identity (57%), as defined by the project³, including: increasing girls' interest in or motivation to pursue STEM careers (46%), increasing their confidence (14%), and/or increasing their interest in STEM topics (14%). Examples of their comments in these and other areas are in Table 1 on the next page.

Figure 5. Educators' perception of the overall goal(s) of the *SciGirls Strategies* (N=28)



³ As defined by the project, and as shared with the educators in their post-webinar formative evaluation survey: *STEM identity integrates confidence, interest and motivation around STEM, and ultimately affects choices, behaviors, persistence and perceptions of STEM careers and STEM professionals.*

Table 1. Perception of the overall goal(s) of the SciGirls Strategies (N=28)

Impact an aspect of STEM identity (57%)

Increase interest in/motivation to pursue STEM careers (46%)

- To encourage and foster the development of STEM identity in girls', thus increasing their interest in ... future careers.
- Present STEM possibilities to girls in a meaningful way that encourages them to participate in and succeed in STEM-based fields.
- Creating opportunity for girls to see themselves as scientists, engineers ...
- I would say the overall goal is to introduce and retain girls in STEM. Girls need to know that they have the skills and motivation required to explore STEM career pathways.
- Give girls a positive experience in STEM so that they can see themselves in a STEM field.

Increase confidence (14%)

- To help young girls be confident in their interests and pursuits (and in turn, themselves) ...
- ... setting the tone for girls to experience/embrace STEM with increased self-confidence and enjoyment.
- To help girls grow confidently and positively as a person but with STEM influences ...

Increase interest in STEM topics (14%)

- To excite interest ...
- To encourage and foster the development of STEM identity in girls, thus increasing their interest in STEM topics, real world issues and future careers.
- ... feeding their self-efficacy and encouraging them to be curious.

Make STEM personal/meaningful (29%)

- Overall goal is getting the program to be more real to the girls; looking at STEM in a different light; extending beyond just a series of activities.
- The overall goal to me is that the SciGirls strategies is giving more opportunity for the girls to make real world connections to their community through doing the SciGirls activities.
- Integrate STEM and STEM attitudes into the girls' everyday life and existence.
- Ensure girls can experience STEM in a way that is meaningful to them ...
- Present STEM possibilities to girls in a meaningful way ...

Incorporate culture responsiveness (18%)

- To make sure that other people's culture is put into consideration.
- More cultural relevancy is apparent.
- The overall goal is to help make STEM appeal for all ethnicity of girls by assisting them in making connections between their lives and STEM careers.
- To weave the thread of inclusion and diversity into all aspects of the SciGirls program

Specifically mentioned STEM identity (14%)

- To encourage and foster the development of STEM identity in girls, thus increasing their interest in STEM topics, real world issues and future careers.
- Develop the STEM identity of girls and help them understand that their STEM identity does not have to match their idea of others in STEM.
- Integration of STEM with personal and social identity
- Promote girls to develop STEM identity.

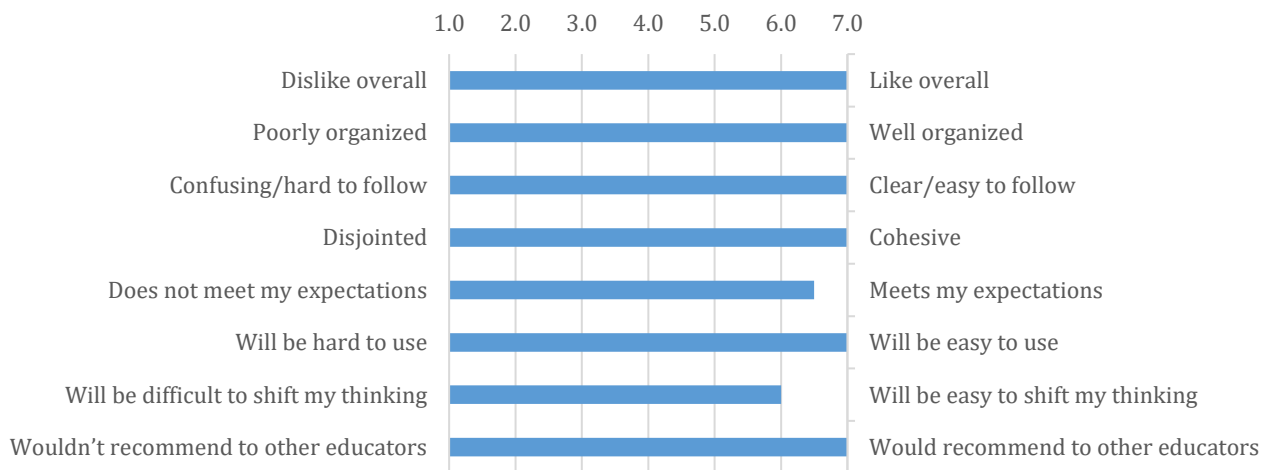
Miscellaneous (11%)

- To integrate science within the classroom and get younger people more involved
- To implement programming that supports all SciGirls strategies
- Create a more comprehensive and defined way of reaching the girls in SciGirls

1.2 Educators' initial responses to the *SciGirls Strategies* as a whole

Figure 6 shows the educators' initial responses to the strategies as a whole, using a rating scale from 1.0 (*rated the lowest*) to 7.0 (*rated the highest*), with 4.0 being neutral in each case. Overall, educators generally: liked the strategies; found them well organized, clear/easy to follow, and cohesive; felt the strategies met their expectations; thought the strategies would be easy to use; thought they would find it easy to shift their thinking from the mindset of the original *SciGirls Seven*; and thought they would recommend the strategies to other educators.

Figure 6. Educators' median rating of the *SciGirls Strategies* as a whole (N=28)



Those who shared a rating of 4.0 or lower were invited to elaborate. In response, five educators commented on various aspects of their ratings, and two commented specifically on the webinar in which the draft updated strategies were introduced, as in:

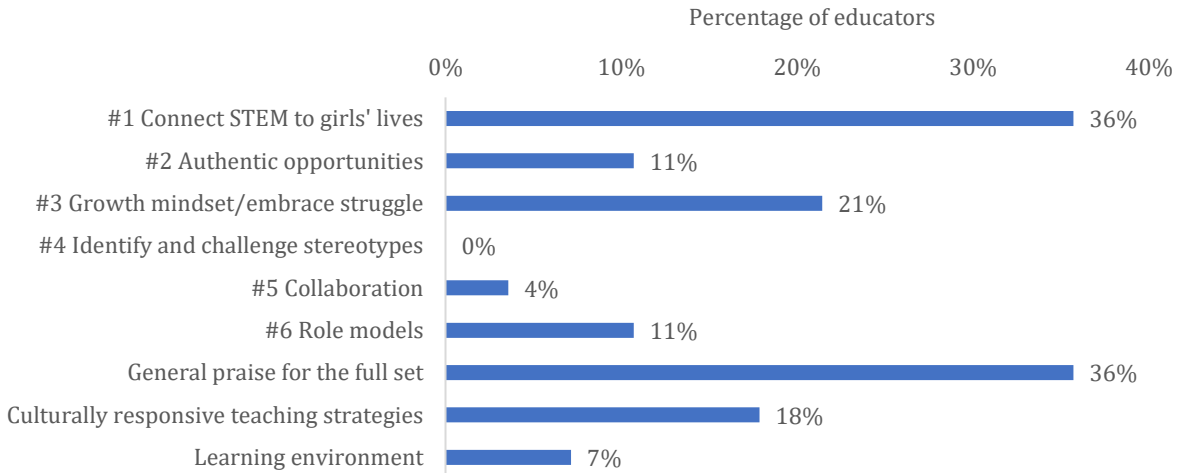
- *I think most of the confusion and difficulty in shifting simply comes from having employed the seven strategies and being familiar with them. I also like that the SciGirls Seven strategies are brief which makes them easier to remember and continue to be conscious of when using them.*
- *I appreciate the desire to integrate cultural [responsiveness] more heavily into the SciGirls Strategies but the extra verbiage makes integration of the strategies SEEM more daunting to someone unfamiliar with the mission of SciGirls. The new strategies incorporate lingo like "growth mindset" that is not necessarily familiar to potential role models and may be intimidating.*
- *The idea of the strategies is great, but when put into practice they could become a little too intense for girls participating in these programs. Understanding the need for a less direct approach to incorporating these strategies into programs may be important. It's not always easy to steer a conversation towards one of these strategies, they may become harder to use.*
- *I am excited for these updates. I feel like this is the right next step.*
- *Thank you so much for giving me an opportunity to be a part of this awesome program. I will definitely work with my SciGirls to help them develop their STEM identity.*
- *I had a little trouble focusing on the webinar, as it was a little hard to hear at times, and a little disorganized. I would have liked to see the webinar given as if it were a presentation for students - with a little more enthusiasm and aesthetically pleasing components. As educators, I would have loved to see you all shine! (With that said, the webinar was very informative and I enjoyed the mix of slides and talking.)*
- *The webinar was very informative and we are super excited about using the framework with the new strategies. One thing I wanted to note was that it was difficult to hear when a new speaker started. They were reading off lots of information very quickly (not on the slides) and it was a bit hard to follow at times. The document that was sent out with this survey (the SciGirls Strategies - DRAFT with tips) was very helpful at summarizing that info, but perhaps if that background was sent prior to the webinar so we could read along in case we couldn't hear? Just a suggestion :)*

1.3 Most and least valuable aspects of the *SciGirls Strategies*

Most valuable aspects

Figure 7 shows what educators perceived to be the most valuable aspects of the draft updated strategies for use in their educational settings. They most often pointed to an aspect of Strategy #1 (36%) or Strategy #3 (21%), or praised the full set (36%). Examples of their comments are in Table 2, on the following two pages.

Figure 7. Most valuable aspects of the *SciGirls Strategies* (N=28)



Least valuable aspects

Figure 8 shows what educators perceived to be the least valuable aspects of the draft updated strategies for use in their educational settings. The largest groups indicated they found nothing least valuable (25%), declined to answer the question (21%), or pointed to an aspect of Strategy #4 (21%). Examples of their comments are in Table 2, on the following two pages.

Figure 8. Least valuable aspects of the *SciGirls Strategies* (N=28)

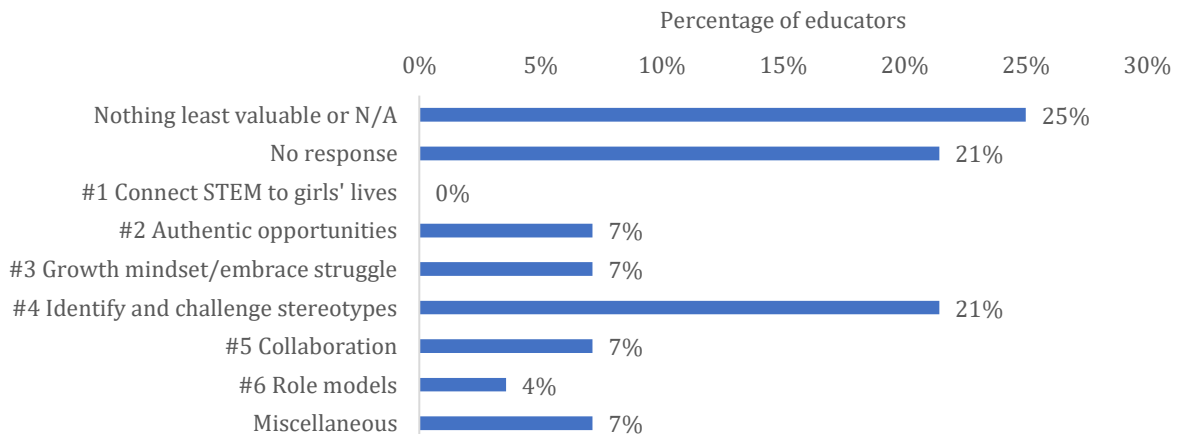


Table 2. What educators perceived to be the most and least valuable aspects of the SciGirls Strategies (N=28)

Most valuable aspects	Least valuable aspects
<p>#1 Connect STEM to girls' lives (36%)</p> <ul style="list-style-type: none"> Connecting STEM experiences to girls' lives is really valuable because it opens a door to a huge diverse world that a lot of adults are not even aware of it. I feel [this strategy] will not only help support the development of the girls' STEM identity, but will also help US to adapt the program as we learn about the girls' personal backgrounds and interests. We may add our own small pre-survey to the survey so we can get some of this information before the program begins and try to highlight issues that girls find most compelling, interesting, or even confusing in our team-building and lesson design. <p>#2 Authentic opportunities (11%)</p> <ul style="list-style-type: none"> [One of] the simplest aspects to execute well in our environment will be ... providing authentic STEM opportunities. Being partners with a research university and engaging in informal STEM education gives us a real leg up ... Our style of educating lends itself well to this. <p>#3 Growth mindset/embrace struggle (21%)</p> <ul style="list-style-type: none"> I love the push to "embrace struggle." This is something that is not available in most traditional classroom settings but is crucial to actual success in a STEM career. The shift to using words like "growth mindset" in the strategy and "embracing struggle" - this gives the real world view that STEM isn't easy but if you persist YOU can achieve anything. I like this directness for educators to use. <p>#5 Collaboration (4%)</p> <ul style="list-style-type: none"> Updated strategy 5 about collaboration is valuable for our setting because our girls really struggle with that and I think it is important that we start with developing the opportunities for them to collaborate rather than just forcing them to collaborate. I think we will get creative in creating these opportunities. <p>#6 Role models (11%)</p> <ul style="list-style-type: none"> Bringing to the table conversations about professionals in STEM that are not as easily recognized is a great way to show girls exactly what is available to them in the future. The diverse STEM role models are SO key and most valuable. It's a constant struggle to ensure all programs are considering this. <p>General praise for the full set (36%)</p> <ul style="list-style-type: none"> The strategies are clear and concise and easy to use for programming. The new strategies will make it easy for teachers not working with STEM full time to implement. I think the updated SciGirls Strategies are excellent and very relatable. The material along with the supporting documents demonstrate the depth of study that went into the development of this work. It speaks clearly to the importance of SciGirls and the focused attention to gender equity in STEM. Less repetitive and thus easier to think about and discuss as distinct strategies. 	<p>Nothing least valuable or N/A (25%)</p> <ul style="list-style-type: none"> I don't think there is anything that is not valuable. Not sure yet - all seems valuable thus far. <p>#2 Authentic opportunities (7%)</p> <ul style="list-style-type: none"> I think Strategy 2's language is a bit wordy and is ambiguous, so this would be the least valuable to our learning environments. When working with low income groups where resources, including space, [are] limited it is harder to create an authentic experience. Because many of these underserved groups have had no experience in science there needs to be guidance on how to follow a scientific process. It cannot just be a free for all. It must be safe. It can still be fun and creative and personal when there is guidance for the process which is most often essential in science. The cost of trial and error is often an economic restriction, as well. Materials may not be abundant enough to repeat over and over due to cost of supplies. <p>#3 Growth mindset/embrace struggle (7%)</p> <ul style="list-style-type: none"> I do believe growth mindset is important but I feel like there is a huge gap in the activities the girls do vs the work the women who work in STEM do as it related to growth mindset. I feel like the girls almost make fun of the growth mindset experience because it's obvious when teachers are "doing it". Although I love the growth mindset strategy, I think it might be the weakest of the strategies. In addition to positive feedback, sometime critical feedback is important to growth. Maybe could talk about giving specific feedback in addition to positive feedback. <p>#4 Identify and challenge stereotypes (21%)</p> <ul style="list-style-type: none"> I would think that #4 is woven into the mission of SciGirls to the point that it is at once the most valuable aspect (as an overarching theme) and least valuable (because it is more of an overarching theme rather than an individual, isolatable goal). While I believe #4 is important I could see some of the wording of feminism being ... off putting to some educators. I don't believe it is necessary to have a conversation about stereotypes with young girls when they may not even be aware of what a stereotype is. I think it creates this state of limbo. I think stereotypes shouldn't even be a discussion until [a] youth is old enough to understand why exactly there are stereotypes and how they don't have any power over them. Introducing stereotypes almost gives the stereotype power over the girls. I'm not sure many of my students understand what some STEM stereotypes may be or feel a need to challenge them ... To identify and challenge stereotypes seems like a tall order for a short time frame. If the girls feel a connection to STEM and know a STEM-based career could happen for them in their world, I personally feel it doesn't matter what everyone else is doing. Sure, STEM-fields are male dominated, but if girls are confident in their own abilities, they can excel in STEM on their own accord, and not necessarily to break a stereotype of what is currently represented.

<p>Culturally responsive teaching strategies (18%)</p> <ul style="list-style-type: none"> • I think it's very valuable to have shifted the strategies to be more focused on developing STEM identity in culturally responsive ways. I think this is more likely to be successful in actually improving girls' overall perception of STEM. • The most valuable aspect is that it's culturally inclined. <p>Learning environment (7%)</p> <ul style="list-style-type: none"> • I think the focus on the learning environment ... will be valuable as we reach out to increasingly diverse audiences ... Working in shared spaces can create a challenge, but we can use some of the tips and integrate these more intentionally. 	<p>#5 Collaboration (7%)</p> <ul style="list-style-type: none"> • Collaboration is important in STEM fields, but it can be really difficult for pre-teen/teen girls who are in a very self-centered stage of development to have positive, successful collaborations. <p>#6 Role models (4%)</p> <ul style="list-style-type: none"> • It is a great strategy to promote STEM by looking up to someone but individual's/student's interest is paramount. <p>Miscellaneous (7%)</p> <ul style="list-style-type: none"> • I like how they are more in-depth explanations for each of the strategies however, I think it will take more time for educators to dissect them and use them in the intended manner.
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Part 2. Feedback on the framework for strategy development

Part 2 considers educators' feedback on the framework for strategy development. Image 3, a slide from the March 2018 webinar presenting the draft updated strategies, outlines the main characteristics of the framework as it was presented to educators. As detailed in the *SciGirls Strategies and Tips* document that accompanied the webinar:

“In addition to the *SciGirls Strategies* themselves, research and practice highlight the need for educators to consider the learning environment in which the *SciGirls Strategies* are situated and to utilize culturally responsive teaching practices to engage and effectively serve all girls in STEM, especially girls of color and girls from marginalized communities. Both, the learning environment and culturally responsive teaching practices, are important in helping foster a STEM identity.”

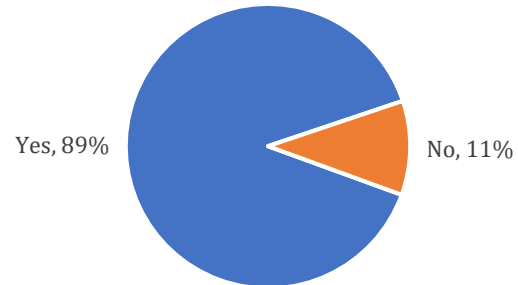


Image 3: Slide from the March 2018 webinar presenting the draft updated *SciGirls Strategies*

2.1 Whether educators could describe the framework to a colleague

Figure 9 shows that most educators (89%) thought they could describe the *SciGirls Strategies* framework and how it relates to the updated strategies to a colleague.

Figure 9. Whether educators thought they could describe the framework to a colleague (N=28)

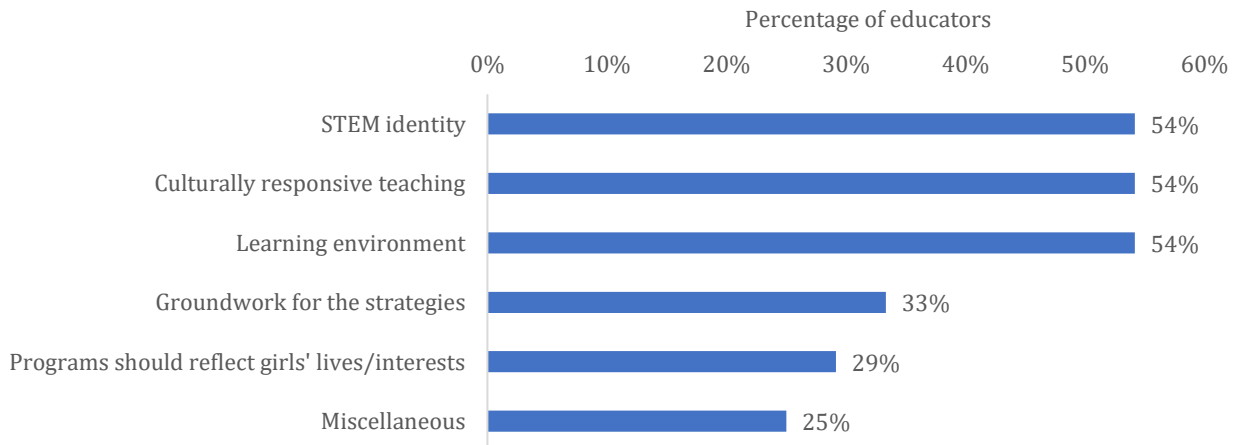


Three educators, meanwhile, indicated that they did not think they could describe the framework and how it relates to the updated strategies to a colleague. One declined to answer the follow-up survey question, “*Briefly describe why not, or what else you feel you need to know to be able to do so.*” The second expressed confusion about STEM identity (“*I know what STEM is, I’m just a bit unclear [on] STEM identity*”), and the third said s/he had difficulty understanding the framework more generally (“*While listening to the webinar, I felt like I couldn’t get a good grasp on the concept of it and I wish I had it in writing instead ... I understand what has been written on the PowerPoint slide, the three bullet points but I felt that I couldn’t understand the presenter well at the time*”).

How educators described the framework

Those who said they could describe the framework were asked what they would tell a colleague. Figure 10 shows the topics of their responses, with STEM identity, culturally responsive teaching, and the learning environment each being mentioned by more than half of the educators (54% each).⁴ Examples of their comments in these and other areas are shared in Table 3 on the next page.

Figure 10. Topics educators thought they would include when describing the framework to a colleague (n=24)



⁴ Although not show in Figure 10, nearly two-fifths of the group mentioned STEM identity, culturally responsive teaching, and the learning environment (38%).

Table 3. Topics educators thought they would include when describing the framework to a colleague (n=24)

STEM identity (54%)

- I'd tell them that STEM identity is being recognized as an important factor in students choosing to pursue careers or continued study in STEM fields, and the updated strategies are taking that research into account.
- The overall goal is to utilize the updated strategies to help girls to develop their own personal STEM identity or way they think and feel about STEM.
- I would explain to a colleague that SciGirls has a goal of wanting young girls to find the scientist within themselves. With there being so many fields in science, SciGirls allows them to explore or discover what their interests are.
- I would tell them that encouraging girls to develop their STEM identity supports the goal of motivating and retaining girls in the STEM pipeline.

Culturally responsive teaching strategies (54%)

- It's also important to develop STEM identities that include girls' cultural identities.
- We also need to ensure that we integrate culturally responsive teaching strategies by recognizing the diversity in our group (and in ourselves) and by building lessons and activities that connect to the experiences, values and backgrounds of the students and allowing those connections to drive the subject matter and discussions in a way that is relevant and meaningful to them.
- I would describe the strategies and make sure that they realize the importance of culturally responsive STEM programming.

Learning environment (54%)

- I'd also mention that STEM identity also involves the environment that learning takes place in, so it's important to create environments that are inviting and engaging to girls.
- ... we need to focus on creating an inclusive, safe and fun learning environment that reflects the diversity of our group including culture/background, learning styles, personalities.
- Establishing a learning environment that promotes vulnerability and a growth mindset is most effective in letting girls know that it's all about learning and constant growth.

Groundwork for the strategies (33%)

- That these important strategies were developed around this framework and really further provides a grounding that supports relevancy for the educator.
- The framework takes into account the multiple strategies it takes to make a difference in encouraging girls in STEM translating to STEM careers. Several components need to be in place for girls to be successful and the framework offers the groundwork to establish these.
- It's a more holistic framework ...
- It helps set the stage for the new strategies, it is concepts that are interwoven into all of the strategies ...

Programs should reflect girls' lives/interests (29%)

- It is important that the program be created with the girls' particular needs/wants/identities in mind, rather than hoping that the girls will be able to connect to independently chosen materials and lessons.
- We also need to ensure that we integrate culturally responsive teaching strategies by recognizing the diversity in our group (and in ourselves) and by building lessons and activities that connect to the experiences, values and backgrounds of the students and allowing those connections to drive the subject matter and discussions in a way that is relevant and meaningful to them.
- [SciGirls] allows for girls to find what is relatable to them and how they can apply what they learned within their own community.
- ... educators need to tap into girls' interests and create projects/opportunities that are relevant and meaningful to them because they feel motivated when they find a connection.

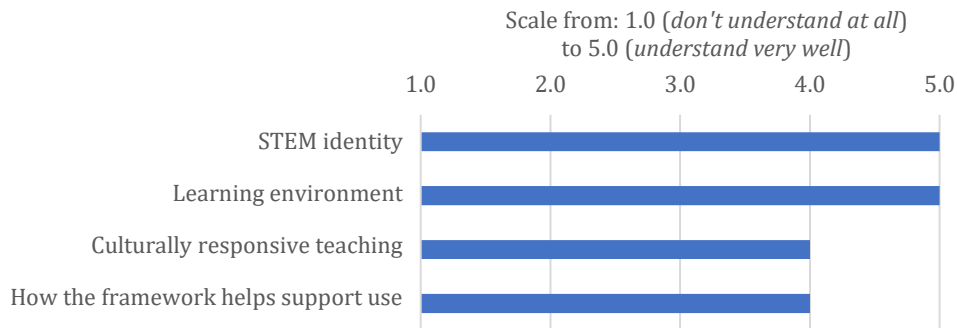
Miscellaneous (25%)

- There are underlying mindsets we need to have as educators that show that we understand our students and the world we live in as it relates to girls excelling in STEM.
- It allows educators to consider multiple aspects when creating programming.
- I'd go over [the] framework as described in the slide above and then give specific examples that connect to the strategies.
- I would tell them that the program is focused on creating positive, long lasting experiences for girls in the STEM field. The teaching strategies provide a real-world experience for the girls that will help develop skills that will create confidence and contacts in a positive environment.

2.2 How well educators thought they understood the framework

Figure 11 shows how well educators thought they understood the framework, using a scale from 1.0 (*don't understand at all*) to 5.0 (*understand very well*). In each case, educators generally thought they understood each aspect of the framework fairly or very well.

Figure 11. Median ratings of educators' understanding of aspects of the framework (N=28)

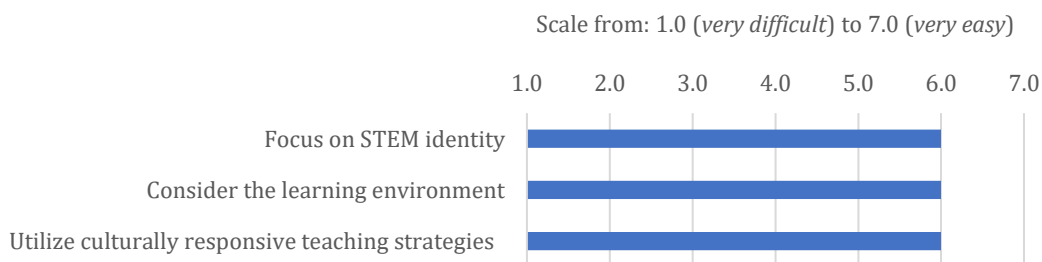


Those who shared a rating of 3.0 or lower were invited to elaborate. One of the educators who indicated s/he understood the aspect of culturally responsive teaching somewhat well elaborated as follows: *“This is the second time I am hearing about culturally responsive teaching and I feel like I need to know more about what it takes to be a culturally responsive teacher. What cultures are we talking about? How do cultures differ? How does how I teach benefit or disadvantage students from specific cultures?”*

2.3 Anticipated ease or difficulty of using the framework

Figure 12 shows how easy or difficult educators thought it would be to use the three different aspects of the framework, using a scale from 1.0 (*very difficult*) to 7.0 (*very easy*). In each case, educators generally thought it would be moderately easy for them to focus on STEM identity, consider the learning environment, and utilize culturally responsive teaching strategies throughout their use of the updated strategies.

Figure 12. Educators' median ratings of anticipated ease of using aspects of the framework (N=28)



Those who shared a rating of 5.0 or lower were invited to elaborate. Examples of educators' responses to each aspect of the framework are shared in Table 4 on the following page.

Table 4. Educators' comments about using aspects of the framework (N=28)

Focus on STEM identity

- *I rated a 5 for "focus on STEM identity" ... [it] would be hard to achieve easily while running this program at an afterschool program setting. There would not be enough time or consistency that would be ideal for them to easily find themselves and discover their STEM identity because of the lack of time or changes in attendance from the girls.*
- *I can say that I am a little nervous delivering these activities and trying to connect it with their STEM identity or developing identity ...*

Consider the learning environment

- *[This] would be hard to achieve easily while running this program at an afterschool program setting ...*
- *Our SciGirls program takes place in a university lecture hall- it's a pretty dull environment and we have very limited resources to expend on making it a more engaging environment. We do go to other places to engage with role models, but these are all very academic/professional environments that don't seem to spark interest in this age group of girls.*
- *Our programs take place after school; not all girls attend each day, therefore, activities and planning are normally spread out amongst several sessions. Because of this, programs & activities are delivered based on girls' availability and do not always run as initially planned. We are always working to schedule things as efficiently as possible.*

Utilize culturally responsive teaching strategies

- *I just need to understand what it takes to be a culturally responsive educators to be successful in our program.*
- *I can say that I am a little nervous ... trying to make it work with their culture as well. The group of girls that we will be delivering this to are girls who are African/American - Somali*
- *I understand tapping into the girls' interest but we have set themes that we base curriculum around and the girls sign up for weeks that they are interested in. I find it most difficult in a classroom too when you have set standards you need to meet to bring in outside topics and interests can be difficult and time consuming. I like the idea of culturally responsive teaching strategies but I feel like it may be difficult to execute.*
- *I think each girl has a unique background, no matter where they come from. We cannot make any assumptions about background or experience. Many things are often hidden from our view. It is important that we do not make generalizations about a specific girl's experience. It can be difficult for many to open up and share due to shyness and even cultural norms or problems in their family. We should not profile a student a certain way just because they come Somalia, for example, or because they are mixed race or Caucasian or they speak Spanish. This process requires patience, kindness, and trust. These relationships which allow more effective communication and learning can happen only over time. Respectfulness is required during this process.*
- *We put in a good effort to learn about our students and their background, but even with this information sometimes it is difficult to figure out how to translate this information into an effective teaching style.*
- *CRTS: Since we don't know who will be in our program until the pre-program meet & greet, we will need to do this as the program is happening. We have several ideas in mind ... but I think this will be the most challenging of the three as we work to create and maintain that inclusive environment while managing the other aspects of the program and getting to know the girls as we go.*

Miscellaneous

- *Work with other educators who lack adaptability. It may be difficult to move forward with a new way of thinking.*
- *I am not directly working with the girls, but would think these strategies are already a part of what we have been doing.*

2.4 Questions about the framework

When asked if they had questions about the framework (including how it relates to the updated strategies and/or how it would help support their use of the strategies), four educators shared a response. Three focused on culturally responsive teaching, while the fourth questioned how the framework would be taught and if examples would be provided. Their comments are shared below. Additionally, one educator explained that “*questions might arise when actually using the framework and strategies.*”

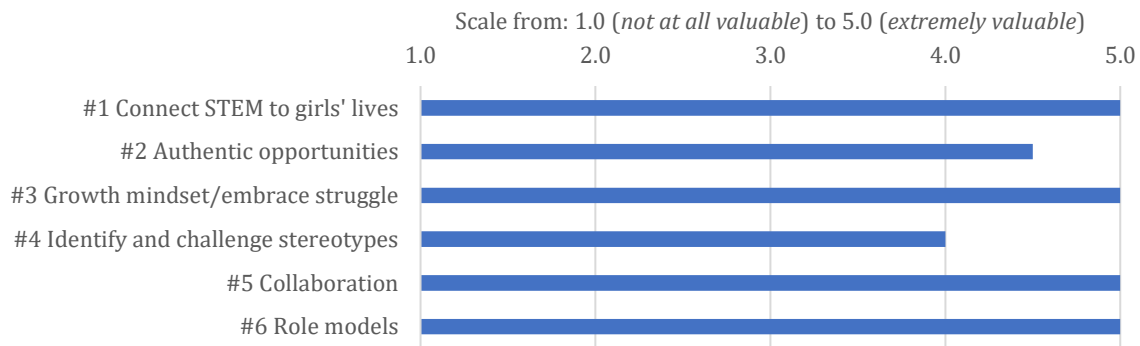
- *Interested to hear more about cultural responsiveness and how that relates to every culture.*
- *As an educator of a short-term program, I question my ability to truly understand what culturally responsive teaching strategies to implement when I am only interacting with the girls for a few days.*
- *More specific ways to interweave culturally responsive [teaching] in all of the strategies. Give examples?*
- *How will the framework be taught to educators before the strategies are introduced? Will examples be given (for how the framework helps support educators' use of the strategies)?*

Part 3. Feedback on the individual *SciGirls Strategies*

3.1 Perceived value of the individual *SciGirls Strategies*

Figure 13 shows how valuable educators thought they would find each of the six *SciGirls Strategies* in their Year 2 programs, using a scale from 1.0 (*not at all valuable*) to 5.0 (*extremely valuable*). Overall, they generally thought they would find each strategy very to extremely valuable.

Figure 13. Educators' median ratings of perceived value of the *SciGirls Strategies* (N=28)

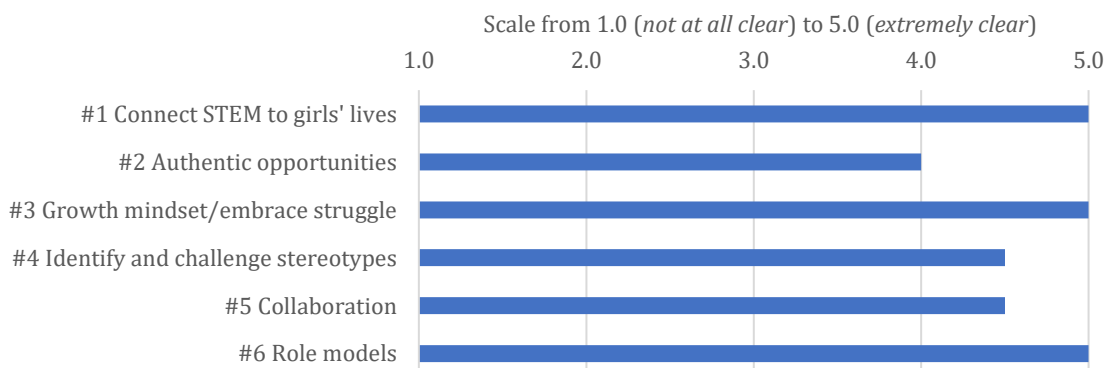


Those who shared a rating of 3.0 or lower were invited to elaborate. In response, one of the educators commented on his or her rating of Strategy #5, saying, “*In the past, girls in our SciGirls program have been somewhat resistant to collaboration, even when encouraged to do so on their own terms and exposed to the role and importance of collaboration in STEM.*”

3.2 Perceived clarity of the individual *SciGirls Strategies*

Figure 14 shows how clear the educators found each of the six *SciGirls Strategies* using a scale from 1.0 (*not at all clear*) to 5.0 (*extremely clear*). Overall, they generally found each of the strategies very to extremely clear.

Figure 14. Educators' median ratings of perceived clarity of the *SciGirls Strategies* (N=28)



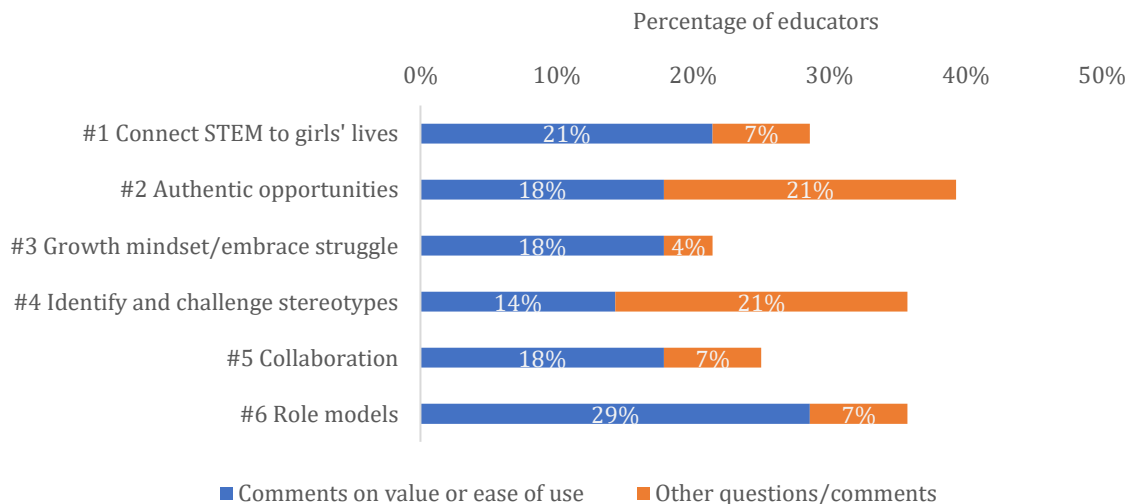
Those who shared a rating of 3.0 or lower were invited to elaborate. In response, three educators commented on various aspects of their ratings, as in:

- *I feel like #2 is too wordy and makes someone read between the lines of what it really means. The other strategies have key words that pop out and this one doesn't seem to as much. Example: #3 Growth Mindset and #4 Encourage and Identify with STEM etc.*
- *#2: I believe more innovative resources/curriculum are needed to truly provide this strategy. We have seen some of the same activities and experiences recycled over and over again in the past 7 to 9 years. It would be great if students could practice/mimic real world STEM experiences through monthly or quarterly kits. #4: We would probably need to research and identify the various STEM stereotypes. Many girls don't really realize that there are various stereotypes in STEM. They just associate their classroom experiences in STEM with their personal ability to enter into any STEM arena. #6: When students live in certain communities their resources to diversity is limited. There are opportunities online by video and annual STEM festivals however additional opportunities would be more effective.*
- *I think that #4 and #5 are ones which, without extra information about what that specifically means to be doing, they are more difficult to understand than the others.*

3.3 Questions or comments about the individual SciGirls Strategies

The educators were asked if they had questions or comments about any of the six individual strategies, for example in terms of clarity, what was intended, or whether a strategy would be immediately actionable. Figure 15 shows the percentages of educators who shared questions or comments about each strategy. Between one-third and two-fifths of the educators had questions or comments about Strategy #2 (39%), Strategy #6 (36%), and Strategy #4 (35%). Somewhat smaller groups had questions or comments about Strategy #1 (28%), Strategy #5 (25%), and Strategy #3 (22%).

Figure 15. Educators who shared questions or comments about the individual SciGirls Strategies (N=28)



All of the educators' comments/questions are presented in Table 5, on the following two pages. In addition, though not included in Table 5, one educator shared the same comment about each of the six strategies: *"I've read through the strategies and don't see any issue being able to present this strategy or make connections with it to actionable practices."*

Table 5. Educators' questions or comments about the SciGirls Strategies (N=28)

#1 Connect STEM to girls' lives (28%)

Commented on value or ease of use (21%)

- *I really like this strategy. It combines two of the past strategies.*
- *This should be quite easy to accomplish as it happens naturally whenever girls gather to participate in a STEM activity. By allowing them to be involved, relaxed and comfortable, they begin to relate and connect what they are doing to themselves and their world.*
- *I really like this piece because students today need to be able to relate to real world experiences that encourage growth.*
- *Immediately actionable ... we are doing this*
- *Very important! Create the story of why tool, etc. is helpful.*

Other questions or comments (7%)

- *This requires tremendous flexibility from the organizers of the program, and it will be difficult to truly get to know the participants quickly enough to line up role models and STEM experiences that truly connect to their individual interests and lives.*
- *Great for all subjects! Not just STEM!*

#2 Authentic opportunities (39%)

Commented on value or ease of use (18%)

- *I like the ownership this gives girls in STEM. They are accountable for their projects.*
- *Girls need to be able to have experiences that can lead them to careers in STEM. Most do not even know the availability of careers that are or will be available to them in the future.*
- *Immediately actionable.*
- *By the time you're a teen, the idea of doing something just for fun, or in a "dumbed-down" way so "little kids" can understand instantly makes them disconnect so this idea of providing authentic opportunities using the same processes as professionals helps keep their attention or makes them feel like they are doing something useful*

Other questions or comments (21%)

- *Some practices of STEM are not accessible or engaging to young girls. I think it's important to pick and choose here.*
- *I would like to see some examples of this in application.*
- *The setting is key as well as the learning preferences and style of participation help guide the experiences of girls in STEM.*
- *There is some challenge inherent in this when resources are limited. Also, when using school space there are requirements of how we can use the space and what can be done in that space. We can obviously adapt and do the best we can, but it may not be ideal.*
- *[Again,] I think Strategy 2's language is a bit wordy and is ambiguous ...*
- *Unsure how to use this strategy. I think hands-on and open-ended need to be added back in... The "develop their own ways..." is clear... I just find the first part unclear.*

#3 Growth mindset/embrace struggle (22%)

Commented on value or ease of use (18%)

- *Excellent - shows girls need perseverance to succeed.*
- *It is important to promote and celebrate struggle and acknowledge that STEM is confusing/challenging, but through problem-solving, practice and perfecting, anything is possible.*
- *It is very important to create a positive thinking method in girls during the teen years. The more they are encouraged to see themselves as life-long learners the more self-confidence they will acquire.*
- *Yes, [I] just graduated with an education degree and this is a common theme we discussed in all my classes.*

Other questions or comments (4%)

- *How do we measure this?*

#4 Identify and challenge stereotypes (35%)

Commented on value or ease of use (14%)

- *Allowing girls to challenge themselves and others will increase their abilities to "fight" and have confidence in their knowledge.*
- *Important! Exciting to see us focus on identity in interest.*
- *Immediately actionable. I think starting the club in the first meeting with a discussion around this area, would be very useful.*

Other questions or comments (21%)

- I've seen some interesting research about how success for women in physics often means developing a more masculine STEM identity. I'm all for girls getting to be their true selves in STEM, but I think the culture of STEM still has a long way to go before it will truly be accepting of women's true identities.
- No questions, but this is one we have to be careful with. As proud and self-proclaimed "nerdy girls" we tend to share our own stereotypes of ourselves. Even though they are positive ones, we will work to be sure we allow the girls to come up with their own ideas about what STEM means to them, not necessarily how we feel about it :)
- This is a good confidence booster - this may be difficult for educators to self-reflect on. anytime there is self-reflection - people offer a bit of push back. That is not a bad thing- just something to be prepared for.
- Start this earlier than teen years!
- Should this be done in isolation or in everyday practice or both?
- Without much-needed explanation, it's important to discourage any stereotypes related to STEM from the terms and language used to the type of activities selected.

#5 Collaboration (25%)

Commented on value or ease of use (18%)

- Very positive!
- Working in teams can allow the shyer or unexperienced girls to learn and feel comfortable in a learning environment.
- [This] happens naturally whenever girls gather to participate in a STEM activity. By allowing them to be involved, relaxed and comfortable, they begin to relate and connect what they are doing to themselves and their world.
- Immediately actionable... I think this is the basis for the club or camp itself.

Other questions or comments (7%)

- This can be one of the more challenging components because in our program it depends on the openness of the educators.
- I like this since it is real world. [I think the Tips document should suggest that longer programs] mix up the groups so the same girls don't work together all the time. This is hard for educators to implement - why rock the boat if things are working?

#6 Role models (36%)

Commented on value or ease of use (29%)

- Role models- diversity for the win!
- Mentors are the most important.
- Inviting diverse role models to be a part of the program allows girls to develop meaningful opportunities to learn how STEM integrates one's personal and professional lives.
- Immediately actionable.
- This is very important that the girls know and learn from people of different backgrounds what it is to have a career in the STEM field.
- Important!!!! This [helps] girls breakdown biases.
- I appreciate this and the fact that there are role models that are ready to share their experiences.

Other questions or comments (7%)

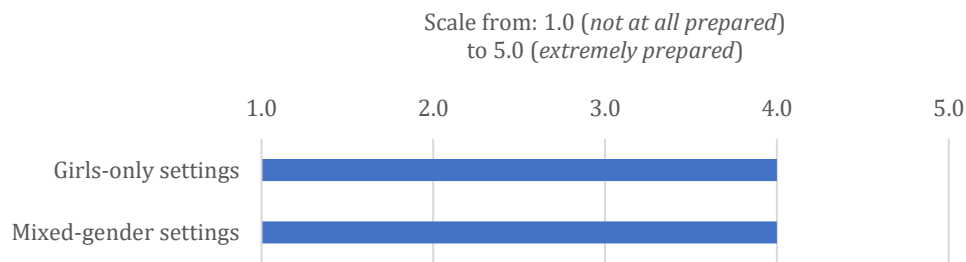
- ... a bit difficult to coordinate
- I feel that it would be difficult to find these role models on my own.

Part 4. Sense of preparation, expected use, and anticipated effectiveness of the *SciGirls Strategies*

4.1 How prepared educators felt to implement the *SciGirls Strategies*

Figure 16 shows how prepared the educators felt to implement the *SciGirls Strategies* in girls-only and mixed-gender settings, using a scale from 1.0 (*not at all prepared*) to 5.0 (*extremely prepared*). In each case the educators generally thought they were very prepared.

Figure 16. Median ratings of how prepared educators felt to use the *SciGirls Strategies* in various settings (N=28)



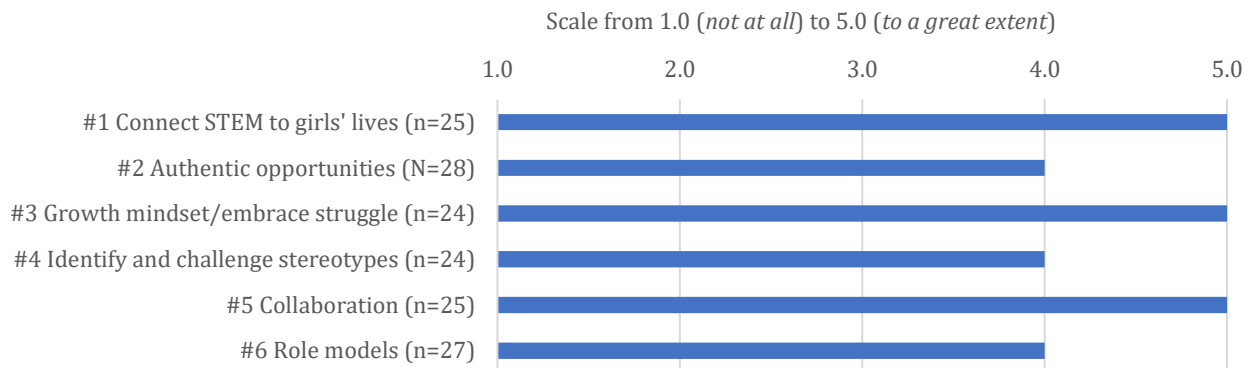
Those who shared a rating of 3.0 or lower were invited to elaborate. In response, six educators commented on various aspects of their ratings, as in:

- *I think that it will be more difficult to implement the strategies in mixed-gender settings because it will be tricky to target one thing and have everyone keep interested and challenge stereotypes in that setting and have girls walk away feeling confident.*
- *As we have not offered this program in a mixed-gender setting, I am unsure of how we would adapt certain strategies. As teachers of course we are fairly flexible, but I feel it would definitely be easier to teach this program to a girls-only group. However, with that said, I do feel also that it is important to include other genders in this conversation and mission of SciGirls.*
- *I'm a white guy. I like to think of myself as a fairly thoughtful and progressive white guy, but no amount of preparation would ever allow me to feel very prepared to deliver programming completely connected to girls' lives.*
- *While I don't think they differ too much from the past strategies, I am nervous about implementing because they are new and I want to make sure we have enough information on how to implement them well.*
- *Our program is currently experiencing a number of changes, so it may take some time and we may not be able to do everything.*
- *It is still early for programming for us and I have not started to think about that yet and will revisit mid-summer.*

4.2 Extent to which educators expected to use the *SciGirls Strategies*

Figure 17 shows the extent to which educators expected to use each of the *SciGirls Strategies* in their Year 2 programs, using a scale from 1.0 (*not at all*) to 5.0 (*to a great extent*). Overall, the educators expected to use each strategy either to a considerable or a great extent.

Figure 17. Median ratings of the extent to which educators thought they would use the *SciGirls Strategies* in their Year 2 programs



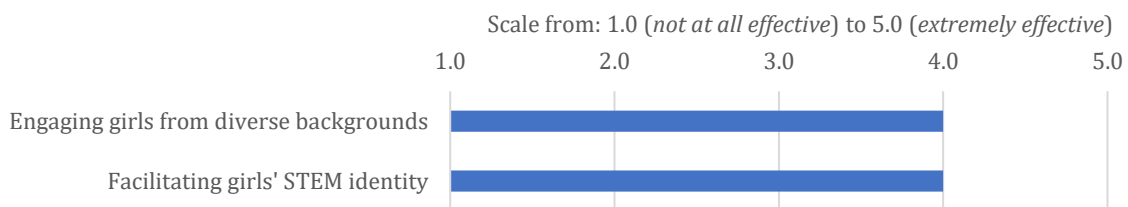
Those who shared a rating of 3.0 or lower were invited to elaborate. In response, two educators commented on various aspects of their ratings, as in:

- *Because our curriculum is preset, it may be challenging to have the girls develop their own hypothesis and their own methods for conducting research. We can definitely relate the work they are doing to the work women in STEM are doing in the workplace.*
- *I need to help the girls identify those stereotypes first before we can overcome them because they are not aware of it at the moment yet.*

4.3 Anticipated effectiveness of the *SciGirls Strategies*

Figure 18 shows how effective the educators thought the *SciGirls Strategies* would be in engaging girls from diverse racial/ethnic and socioeconomic backgrounds and facilitating girls' STEM identity⁵, using a scale from 1.0 (*not at all effective*) to 5.0 (*extremely effective*). In each case, the educators generally thought the strategies would be very effective.

Figure 18. Educators' median ratings of the effectiveness of the *SciGirls Strategies* (N=28)



⁵ As defined by the project, and as shared with the educators in their post-webinar formative evaluation survey: *STEM identity integrates confidence, interest and motivation around STEM, and ultimately affects choices, behaviors, persistence and perceptions of STEM careers and STEM professionals.*

Those who shared a rating of 3.0 or lower were invited to elaborate. In response, three educators commented on various aspects of their ratings, as in:

- *I am just not sure because I know the girls for who they are right now and we will see how they do when we execute this program in the fall.*
- *I think that participant recruitment is a separate battle from program implementation. Engaging girls from diverse backgrounds is only possible if we can effectively recruit (and in some cases transport) girls from diverse backgrounds.*
- *Most girls who have a strong interest in STEM are motivated by family members who are in STEM careers and have introduced the girls to STEM the path directly or indirectly. These families know the economic benefits of exploring a STEM career. I believe encouraging STEM identity is a systematic challenge that goes beyond afterschool programs and weekend STEM experiences ...while some school experiences are effective in encouraging interest and motivation[around] STEM. It is imperative that girls know that there is some type of consistency, support and encouragement in high school and college, and beyond.*

Part 5: Anticipated barriers or challenges and recommended support

5.1 Anticipated barriers or challenges in using the SciGirls Strategies

Figure 19 shows the barriers or challenges educators said they expected to face in using the draft updated strategies in their educational settings. The largest groups of educators declined to answer the question (36%) or indicated they had no concerns (21%). Examples of their responses are shared in Table 6 on the following page.

Figure 19. Anticipated barriers or challenges in using the SciGirls Strategies (N=28)

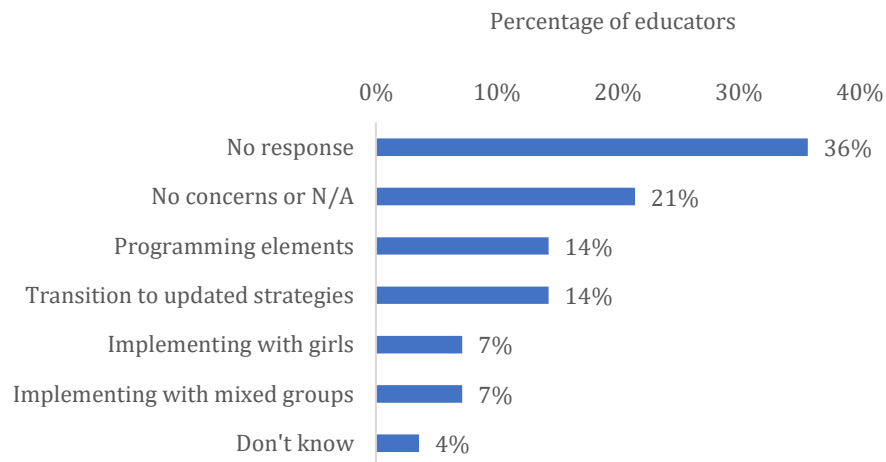


Table 6. Anticipated barriers or challenges in using the *SciGirls Strategies* (N=28)

No concerns or N/A (21%)

- *I don't feel there will be any challenges, in fact, I think this will provide a lot of clarity. The tips were excellent -- very helpful.*
- *None*
- *NA*

Programming elements (14%)

- *This isn't a case of "if you build it they will come..." Participant recruitment strategies would be helpful (bearing in mind that we don't have a vibrant marketing arm and our Outreach program has never been tasked with participant recruitment).*
- *As we have not yet decided on our space where our program will be offered, we are also unsure about what type of girls we will be teaching. This is not necessarily a concern, but our program may flow very differently this round than last.*
- *A barrier for us may be the cost or options available for bringing our girls on a field trip or the ability to expose them to STEM related businesses in our own community. How welcoming would a business be? How relatable would it be to our girls? Also, another barrier is the time constraint that we have, we have afterschool programs, and have limited time each day with the girls for program time.*
- *A barrier/challenge for our educational setting would be the amount of options we have in our city for them to explore. Also, the cost may be an issue depending on the place we are going, transportation costs, and how many girls go. Another thing is the time constraint. We possibly wouldn't have enough time to take them on a trip by the time they get to our facility.*

Transition to updated strategies (14%)

- *Our program is very structured so I am worried about some of the open-ended nature of most of the strategies that it will take a balance between what we are programmed to do and spending time on the new strategies.*
- *I think we excel at ... the STEM aspects of the strategies (more reflected in the old strategies) but we will be putting more of an emphasis on the other aspects of the framework which we are less experienced with. I think we may have some pre-conceived notions of what "works" and will need to be adaptive and learn as the program progresses.*
- *Our program is in transition. We will be able to update some of what we do, but it may be challenging to do everything.*
- *Getting this across to our entire educator staff could also prove difficult depending on their open-mindedness and ability.*

Implementing with girls (7%)

- *Getting the girls to collaborate is always difficult, so I anticipate having some challenges when it comes to creating the opportunities for them to do so.*
- *It is just a little bit of a concern to see how this can be used with girls that are really active and energetic to have sit down and do an experiment that is still interactive and fun but the change will be different.*

Implementing with mixed-gender groups (7%)

- *I think my biggest challenge will be some of the strong male personalities I have in my groups that can hinder the girls feeling comfortable or feeling like they can fail or having interest in things that might not be considered "cool" by their friends.*
- *While we have one girls-only week of camp this summer, the other 19 camps are mixed-gender. I don't exactly see this as a barrier but certainly as a challenge to implement. I'm looking forward to seeing what strategies are most difficult to properly implement and what my colleagues find works best.*

Don't know (4%)

- *Not sure yet - need to actually present them in order to figure out if any get more questions, are harder to share examples for, etc.*

Concerns about using the *SciGirls Strategies* with older *SciGirls* activities and media

When asked if they had specific concerns about using the draft updated strategies while implementing existing *SciGirls* activities or media that were developed with the original *SciGirls Seven* in mind, two educators shared a response:

- *How do we incorporate the new into the old? How can we repurpose the materials? Do you plan to provide new materials to drive educators to the connect website?*
- *We need to totally complete each session. There is no space to store anything to be continued. Video ideas and projects are very interesting but often cannot be replicated in the space and time provided. We cannot use the computer resources in class due to lack of computers. But, we will use the new strategies to the fullest in the conditions we have.*

5.2 Suggested support to help educators implement the *SciGirls Strategies*

Figure 20 shows educators’ suggestions regarding things TPT might do or provide in order to help them feel more prepared to implement the *SciGirls Strategies*. Slightly less than half of the educators shared a suggestion, with the largest group recommending TPT provide additional tips and examples (32%), including in the areas of working with mixed-gender groups, coordinating programs of different lengths, and incorporating culturally responsive teaching strategies. Examples of their responses are shared in Table 7, below and on the following page.

Figure 20. Things TPT might do or provide to help educators feel better prepared to implement the *SciGirls Strategies* (N=28)

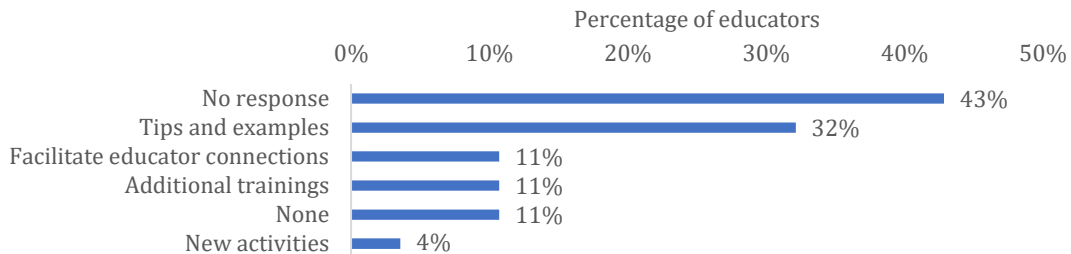


Table 7. Suggested support educators thought would help them feel better prepared to implement the *SciGirls Strategies* (N=28)

Tips and examples (32%)

- *I liked the tips in the draft of the strategies with little ideas of how to incorporate those specific strategies, I think if I had more of maybe how to work with that in mixed-gender situations it will help with my every day work beyond my program for SciGirls Connect²*
- *Strategies for implementing in mixed-gender groups.*
- *I think examples of each of the strategies or suggestions of some ways to incorporate them into lessons would be helpful.*
- *Another idea would be to have a page where there are videos for educators on how to do the projects. I feel as though it would make the educator feel more prepared to do the project if they had a general idea of how to do it.*
- *It would be great to see a new workbook of ideas come out of this which might be more effective than some of the ones already in the SciGirls work books, or more suited to the time frame we have to work in each individual session.*
- *Examples of each of the strategies in action! More information about being culturally responsive!*
- *I watched the snapshots on culturally responsive teaching strategies, but it would be awesome if there were more specific examples of how this is done in a non-permanent setting (e.g.: weeklong program) such as ours. I think we do okay with this, but we would love to have more tools to do it better.*
- *I would love to have more specific examples of how to interact with students of diverse backgrounds and how to incorporate cultural issues into our programming.*

Facilitate educator connections (11%)

- *Promotional and marketing support for presenting at conferences and engaging educators or programs will be very much appreciated ... Also, any support for re-engaging programs or educators trained years ago, would be awesome too! Thank you!!*
- *I think it would be helpful to talk with other facilitators about best practices, how the program is going, etc. I'd suggest maybe a group chat, a Facebook group, maybe a group email, so that facilitators/educators can reach out to one another and bounce ideas, helpful tips, etc.*
- *It may be helpful to be able to get in contact with other educators who are participating. Sort of like a chat group or Facebook group where educators can openly share ideas, concerns, tips, etc. about how to run an activity or anything they want about implementing. The idea is having an open, friendly space to just chat among other educators who are doing the SciGirls Program.*

Additional trainings (11%)

- *A training webinar would be good to dive deeper and offer more tips on implementing the strategies. I'm comfortable, but I can see other educators not being so comfortable.*
- *I would say we could use professional development for the new teachers and or mentors who will work with students.*
- *I might need additional training in the future but I will ask Niki when I get to that point.*

None (11%)

- *I think the information in the article as well as the online video provide more than enough information for one to understand the updated strategies with tremendous research supporting the strategies.*
- *Nope --- just give us the go ahead to start using them and training others on them. I feel like I'd have much better answers to all of these questions after using them to train educators.*

New activities (4%)

- *Also, NEW Activities to use in the trainings that incorporate the new strategies please?*

Part 6. Suggestions for finalizing the *SciGirls Strategies*

Educators were invited to share revisions and additions to the draft *SciGirls Strategies* in their formative survey. They were also given an opportunity to “think outside the box” and share other recommendations related to the strategies as a whole, individual strategies, and/or the tips provided by TPT (in the *SciGirls Strategies and Tips* document) in an effort to leave open the possibility of changes to the *SciGirls Strategies* beyond updates or modifications.

In response, one educator suggested a revision to the draft updated *SciGirls Strategies*, one shared a proposed addition, and three shared other recommendations. Given the relative lack of feedback shared in direct response to this survey question, the evaluation team reviewed each educator’s full set of survey responses to look for suggested revisions, additions, and recommendations. Examples of all of the educators’ suggestions for the *SciGirls Strategies* that were shared throughout their surveys are below.

6.1 Proposed revisions

Throughout their surveys, a few educators proposed revisions to the *SciGirls Strategies*, including rewording Strategies #2, #3, and #4 and clarifying aspects of Strategies #4 and #5. Their comments about these strategies are in Table 8.

Table 8. Suggested revisions to the *SciGirls Strategies* (N=28)

Strategy #2

- *Consider rewording Strategy 2... I think [the] language [of this strategy] is a bit wordy and is ambiguous*
- *I feel like [strategy] 2 is too wordy and makes someone read between the lines of what it really means. The other strategies have key words that pop out and this one doesn't seem to as much, [such as] #3 Growth Mindset and #4 Encourage and Identify with STEM etc. ... [I'm also] unsure how to use this strategy ... "Develop their own ways..." is clear... I just find the first part unclear.*

Strategy #3

- *... the extra verbiage makes integration of the strategies SEEM more daunting to someone unfamiliar with the mission of SciGirls. The new strategies incorporate lingo like "growth mindset" that is not necessarily familiar to potential role models and may be intimidating.*

Strategy #4

- *While I believe strategy 4 is important I could see some of the wording of feminism being used as off putting to some educators.*
- *I think that #4 and #5 are ones which, without extra information about what that specifically means to be doing, they are more difficult to understand than the others.*

Strategy #5

- *I think that #4 and #5 are ones which, without extra information about what that specifically means to be doing, they are more difficult to understand than the others.*

6.2 Proposed additions

Three educators suggested TPT make specific additions to the updated *SciGirls Strategies*, including one who proposed incorporating a focus on critical thinking (a strategy that was removed in the transition from the original *SciGirls Seven*), another who suggested incorporating language from the *SciGirls Seven* into Strategy #2, and a third who suggested expanding Strategy #3 to include critical feedback, as in:

- *I was disappointed that the critical thinking of the SciGirls Seven was eliminated in the revised strategies. I still think it is a vital part.*
- *I think hands-on and open-ended need to be added back in [to Strategy #2] ...*
- *Although I love the growth mindset strategy, I think it might be the weakest of the strategies. In addition to positive feedback, sometime critical feedback is important to growth. Maybe could talk about giving specific feedback in addition to positive feedback.*

6.3 Other recommendations

Finally, throughout their surveys, a number of educators shared other recommendations for the *SciGirls Strategies* or factors they thought the project team might want to keep in mind as they finalize the strategies. When sharing other recommendations, the educators commented on: Strategies #1, #2, and #4; the framework for strategy development; their interest in additional trainings or illustrations of the strategies in use; and how they might work with other educators to facilitate their transition to the updated strategies. Although these subjects are discussed in greater detail throughout this report, examples of educators' comments in each area are in Table 9, below and on the following page.

Table 9. Other recommendations or factors educators thought the project team might keep in mind as they finalize the *SciGirls Strategies* (N=28)

Strategy #1

- *I think each girl has a unique background, no matter where they come from. We cannot make any assumptions about background or experience. Many things are often hidden from our view. It is important that we do not make generalizations about a specific girl's experience. It can be difficult for many to open up and share due to shyness and even cultural norms or problems in their family. We should not profile a student a certain way just because they come Somalia, for example, or because they are mixed race or Caucasian or they speak Spanish. This process requires patience, kindness, and trust. These relationships which allow more effective communication and learning can happen only over time. Respectfulness is required during this process.*

Strategy #2

- *I believe more innovative resources/curriculum are needed to truly provide this strategy. We have seen some of the same activities and experiences recycled over and over again in the past 7 to 9 years. It would be great if students could practice/mimic real world STEM experiences through monthly or quarterly kits.*
- *Some practices of STEM are not accessible or engaging to young girls. I think it's important to pick and choose here.*
- *When working with low income groups where resources, including space, [are] limited it is harder to create an authentic experience. Because many of these underserved groups have had no experience in science there needs to be guidance on how to follow a scientific process. It cannot just be a free for all. It must be safe. It can still be fun and creative and personal when there is guidance for the process which is most often essential in science. The cost of trial and error is often an economic restriction, as well. Materials may not be abundant enough to repeat over and over due to cost of supplies.*

Strategy #4

- *We would probably need to research and identify the various STEM stereotypes. Many girls don't really realize that there are various stereotypes in STEM. They just associate their classroom experiences in STEM with their personal ability to enter into any STEM arena.*
- *I need to help the girls identify those stereotypes first before we can overcome them because they are not aware of it at the moment yet.*
- *To identify and challenge stereotypes seems like a tall order for a short time frame.*
- *... this is one we have to be careful with. As proud and self-proclaimed "nerdy girls" we tend to share our own stereotypes of ourselves. Even though they are positive ones, we will work to be sure we allow the girls to come up with their own ideas about what STEM means to them, not necessarily how we feel about it :)*
- *... this may be difficult for educators to self-reflect on. Anytime there is self-reflection - people offer a bit of push back. That is not a bad thing- just something to be prepared for.*
- *Start this earlier than teen years!*

Framework for strategy development (including the learning environment and CRT)

- *How will the framework be taught to educators before the strategies are introduced? Will examples be given (for how the framework helps support educators' use of the strategies)?*
- *As I mentioned earlier, it seems to me that the entire SciGirls program is designed around the mission to "Encourage girls to identify and challenge STEM stereotypes and bring their true selves to the learning space." Isn't that idea woven into the fabric of the program just as deeply as creating an inclusive [learning] environment?*
- *We put in a good effort to learn about our students and their background, but even with this information sometimes it is difficult to figure out how to translate this information into an effective teaching style... I would love to have more specific examples of how to interact with students of diverse backgrounds and how to incorporate cultural issues into our programming.*
- *As an educator of a short-term program, I question my ability to truly understand what culturally responsive teaching strategies to implement when I am only interacting with the girls for a few days.*

Additional trainings or illustrations

- *A training webinar would be good to dive deeper and offer more tips on implementing the strategies. I'm comfortable, but I can see other educators not being so comfortable.*
- *From a training perspective, providing concrete examples of how to implement these strategies in yearlong program. I am excited to learn ways to retrain programs that we have trained to use SciGirls, and to train new ones using the new strategies.*
- *Just as we move forward providing specific examples of and coaching on how these strategies are enacted.*
- *Another idea would be to have a page where there are videos for educators on how to do the projects. I feel as though it would make the educator feel more prepared to do the project if they had a general idea of how to do it.*
- *It would be great to see a new workbook of ideas come out of this which might be more effective than some of the ones already in the SciGirls workbooks, or more suited to the time frame we have to work in each individual session.*
- *The idea of the strategies is great, but when put into practice they could become a little too intense for girls participating in these programs. Understanding the need for a less direct approach to incorporating these strategies into programs may be important. It's not always easy to steer a conversation towards one of these strategies, they may become harder to use.*

Working with other educators to facilitate the transition

- *I think it would be helpful to talk with other facilitators about best practices, how the program is going, etc. I'd suggest maybe a group chat, a Facebook group, maybe a group email, so that facilitators/educators can reach out to one another and bounce ideas, helpful tips, etc.*
- *It may be helpful to be able to get in contact with other educators who are participating. Sort of like a chat group or Facebook group where educators can openly share ideas, concerns, tips, etc. about how to run an activity or anything they want about implementing. The idea is having an open, friendly space to just chat among other educators who are doing the SciGirls Program.*

Discussion

The overarching goal of *SciGirls CONNECT*² 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 CONNECT*² 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 CONNECT*² presents findings regarding partner educators’ anticipated use of, reflections on, and recommendations relating to the draft updated *SciGirls Strategies*, which were first distributed by TPT via a mid-project webinar in March 2018 and an accompanying six-page document, *SciGirls Strategies and Tips*. Their feedback is shared in four main areas: 1) feedback about the framework for strategy development; 2) perceptions and anticipated use of the individual *SciGirls Strategies*; 3) perceptions of and initial response to the *SciGirls Strategies* overall; and 4) suggestions relating to the *SciGirls Strategies*.

Looking across the findings, a few additional observations are also provided in an effort to help inform the project’s effort to finalize the updated *SciGirls Strategies*.

Educators’ feedback about the framework for strategy development

The overarching framework for strategy development is described in the *SciGirls Strategies and Tips* document as follows:

“In addition to the *SciGirls Strategies* themselves, research and practice highlight the need for educators to consider the learning environment in which the *SciGirls Strategies* are situated and to utilize culturally responsive teaching practices to engage and effectively serve all girls in STEM, especially girls of color and girls from marginalized communities. Both, the learning environment and culturally responsive teaching practices, are important in helping foster a STEM identity.”

Focusing on the three main aspects described above – considering the learning environment, utilizing culturally responsive teaching practices, and the outcome of fostering girls’ STEM identity – the evaluation sought educators’ feedback on how well they thought they understood each aspect, as well as the anticipated ease or difficulty of incorporating each aspect into their use of the updated strategies. Additionally, the educators were asked to comment on the relationship between the framework and the updated strategies. Their responses in each of these areas are summarized below.

Consider the learning environment

Overall, educators thought they understood this aspect of the framework very well and thought it would be moderately easy for them to consider the learning environment throughout their use of the updated strategies. Additionally, when asked to explain how they would describe the framework for strategy development to a colleague, more than half of the educators touched upon the importance of considering the learning environment in their use of the *SciGirls Strategies* (54%), as in: “... we need to focus on creating an inclusive, safe and fun learning environment that reflects the diversity of our group including culture/background, learning styles, personalities.” Finally, nearly a tenth found the focus on the learning environment to be the most valuable aspect of the updated strategies (7%).

Utilize culturally responsive teaching practices

Overall, educators thought they understood this aspect of the framework fairly well and thought it would be moderately easy for them to utilize culturally responsive teaching practices throughout their use of the updated strategies. Additionally, when asked to explain how they would describe the framework for strategy development to a colleague, more than half of the educators touched upon the importance of utilizing culturally responsive teaching practices in their use of the *SciGirls Strategies* (54%), as in: “We also need to ensure that we integrate culturally responsive teaching strategies by recognizing the diversity in our group (and in ourselves) and by building lessons and activities that connect to the experiences, values and backgrounds of the students and allowing those connections to drive the subject matter and discussions in a way that is relevant and meaningful to them.” Furthermore, a fifth explained that they found the inclusion of culturally responsive teaching practices to be the most valuable aspect of the updated strategies (18%).

Although the educators were generally enthusiastic about this aspect of the framework throughout their surveys (as in, “I appreciate the desire to integrate cultural [responsiveness] more heavily into the *SciGirls Strategies*”), some had questions about it or indicated they would benefit from additional guidance. For example, when asked if they had any questions about the framework, the few educators who shared a response tended to focus on culturally responsive teaching, as in: “More specific ways to interweave [cultural responsiveness] in all of the strategies. Give examples?” and “As an educator of a short-term program, I question my ability to truly understand what culturally responsive teaching strategies to implement when I am only interacting with the girls for a few days.”

Foster girls’ STEM identity

Overall, educators thought they understood this aspect of the framework very well and thought it would be moderately easy for them to focus on girls’ STEM identity throughout their use of the updated strategies. Additionally, when asked to explain how they would describe the framework for strategy development to a colleague, more than half of the educators touched upon the importance of fostering girls’ STEM identity in their use of the *SciGirls Strategies* (54%), as in: “The overall goal is to utilize the updated strategies to help girls to develop their own personal STEM identity or way they think and feel about STEM.”

How the framework relates to the updated SciGirls Strategies

Overall, educators thought they understood how the framework relates to the updated strategies fairly well. Additionally, nearly all of the educators thought they could describe the

framework and how it relates to the updated strategies to a colleague (89%). As noted above, when asked to describe what they would tell a colleague about the framework, the three main aspects addressed in the webinar and in TPT's *SciGirls Strategies and Tips* document – the learning environment, culturally responsive teaching, and STEM identity – were each mentioned by just over half of the educators (54% each), while nearly two-fifths of the group mentioned all three elements (38%), with other responses being shared less often.

Educators' perceptions and anticipated use of the individual *SciGirls Strategies*

The evaluation sought educators' feedback on each of the draft updated *SciGirls Strategies* at various points in the formative survey, which – when combined and looked at by individual strategy – amount to considerable feedback on each strategy's clarity, perceived value, and anticipated use. Educators' feedback on each of the six strategies is summarized below.

#1 Connect STEM to girls' lives: Overall, educators found Strategy #1 extremely clear, thought it would be extremely valuable in their Year 2 programs, and anticipated that they would use it to a great extent in Year 2. More than one-third of educators thought an aspect of Strategy #1 would be most valuable for use in their educational settings (36%)⁶, while none of the educators thought they would find an aspect of this strategy least valuable (0%). Additionally, when invited to share questions or comments about the individual strategies, one-fifth of the educators commented on the value or ease of use of Strategy #1 (21%), while less than tenth shared other questions or comments (7%), such as: *"This requires tremendous flexibility from the organizers of the program, and it will be difficult to truly get to know the participants quickly enough to line up role models and STEM experiences that truly connect to their individual interests and lives."*

#2 Provide authentic STEM opportunities that mirror the practices of STEM and help girls develop their own ways of exploring and sharing knowledge: Overall, educators found Strategy #2 very clear, thought it would be very-to-extremely valuable in their Year 2 programs, and anticipated that they would use it to a considerable extent in Year 2. One-tenth of educators thought an aspect of Strategy #2 would be most valuable for use in their educational settings (11%), while less than one-tenth thought they would find an aspect of this strategy least valuable (7%). Additionally, when invited to share questions or comments about the individual strategies, one-fifth of the group commented on the value or ease of use of Strategy #2 (18%), while one-fifth shared other questions or comments (21%), including: *"I think Strategy 2's language is a bit wordy and is ambiguous," "I would like to see some examples of this in application," and "Some practices of STEM are not accessible or engaging to young girls. I think it's important to pick and choose here."*

#3 Promote a growth mindset in girls to help them embrace struggle, overcome challenges, and increase self-confidence in STEM: Overall, educators found Strategy #3

⁶ In addition to those who cited individual strategies, one-third of educators found the full set most valuable (36%), one-fifth mentioned culturally responsive teaching (18%), and less than one-tenth pointed to the focus on the learning environment (7%).

extremely clear, thought it would be extremely valuable in their Year 2 programs, and anticipated that they would use it to a great extent in Year 2. One-fifth of educators thought an aspect of Strategy #3 would be most valuable for use in their educational settings (21%), while less than one-tenth thought they would find an aspect of this strategy least valuable (7%). Additionally, when invited to share questions or comments about the individual strategies, one-fifth of the educators commented on the value or ease of use of Strategy #3 (18%), while less than a tenth shared other questions or comments (4%), as in: *“How do we measure this?”*

#4 Encourage girls to identify and challenge STEM stereotypes and bring their true selves to the learning space: Overall, educators found Strategy #4 very-to-extremely clear, thought it would be very valuable in their Year 2 programs, and anticipated that they would use it to a considerable extent in Year 2. None of educators thought an aspect of Strategy #4 would be most valuable for use in their educational settings (0%), while one-fifth thought they would find an aspect of this strategy least valuable (21%). Finally, when invited to share questions or comments about the individual strategies, more than one-tenth of the educators commented on the value or ease of use of Strategy #4 (14%), while one-fifth shared other questions or comments (21%), including: *“This is one we have to be careful with. As proud and self-proclaimed ‘nerdy girls’ we tend to share our own stereotypes of ourselves. Even though they are positive ones, we will work to be sure we allow the girls to come up with their own ideas about what STEM means to them, not necessarily how we feel about it.”*

#5 Develop opportunities for girls to collaborate and collectively engage in experiences that highlight the social nature of STEM: Overall, educators found Strategy #5 very-to-extremely clear, thought it would be extremely valuable in their Year 2 programs, and anticipated that they would use it to a great extent in Year 2. Less than one-tenth of educators thought an aspect of Strategy #5 would be most valuable for use in their educational settings (4%), while less than one-tenth thought they would find an aspect of this strategy least valuable (7%). Additionally, when invited to share questions or comments about the individual strategies, one-fifth of the educators commented on the value or ease of use of Strategy #5 (18%), while less than one-tenth shared other questions or comments (7%), including: *“I like this since it is real world. [I think the Tips document should suggest that longer programs] mix up the groups so the same girls don't work together all the time. This is hard for educators to implement - why rock the boat if things are working?”*

#6 Provide opportunities for girls to interact with and learn from diverse STEM role models: Overall, educators found Strategy #6 extremely clear, thought it would be extremely valuable in their Year 2 programs, and anticipated that they would use it to a considerable extent in Year 2. One-tenth of educators thought an aspect of Strategy #6 would be most valuable for use in their educational settings (11%), while less than one-tenth thought they would find an aspect of this strategy least valuable (4%). Additionally, when invited to share questions or comments about the individual strategies, more than one-quarter commented on the value or ease of use of Strategy #6 (29%), while less than a tenth shared other questions or comments (7%), such as: *“I feel that it would be difficult to find these role models on my own.”*

Looking across the educators' individual strategy responses, the findings indicate that they generally found each of the six strategies very to extremely clear. They also generally thought they would find each strategy very to extremely valuable in their Year 2 programs, and expected to use each strategy to a considerable or great extent in Year 2.

Educators' perceptions of and initial response to the *SciGirls Strategies* overall

In addition to eliciting educators' feedback on each of the individual draft updated *SciGirls 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 updated strategies; their initial responses to the strategies as a whole; the anticipated effectiveness of the strategies as a whole; any barriers or challenges they expected to face in their use of the strategies; and their sense of preparation and what TPT might do or provide in order to help them feel more prepared to implement the updated strategies. Educators' responses to these broader questions are summarized below.

Goal of the SciGirls Strategies

When asked to describe the overall goal of the draft updated *SciGirls Strategies*, nearly three-fifths of the educators focused on one or more aspects of fostering girls' STEM identity (57%), as defined by the project⁷, including: increasing girls' interest in or motivation to pursue STEM careers (46%), increasing their confidence (14%), and/or increasing their interest in STEM topics (14%). Additionally, more than one-quarter of the educators thought the goal of the updated strategies was to make STEM personal or meaningful to girls (29%), while about one-fifth thought they were meant to incorporate cultural responsiveness (18%) and one-tenth shared miscellaneous goals (11%).

Initial responses to the SciGirls Strategies as a whole

Overall, educators generally: liked the strategies; found them well organized, clear/easy to follow, and cohesive; felt the strategies met their expectations; thought the strategies would be easy to use; thought they would find it easy to shift their thinking from the mindset of the original *SciGirls Seven*; and thought they would recommend the strategies to other educators.

Anticipated effectiveness of the SciGirls Strategies

Overall, the educators generally thought the strategies would be very effective in engaging girls from diverse racial/ethnic and socioeconomic backgrounds and in facilitating girls' STEM identity, as defined by the project.

Anticipated barriers or challenges in using the SciGirls Strategies

When asked if they expected to face any barriers or challenges in using the draft updated strategies in their educational settings, no one issue stood out among the educators. A third declined to answer the question (36%), while a fifth indicated they had no concerns (21%).

⁷ As defined by the project, and as shared with the educators in their post-webinar formative evaluation survey: *STEM identity integrates confidence, interest and motivation around STEM, and ultimately affects choices, behaviors, persistence and perceptions of STEM careers and STEM professionals.*

About a tenth each shared specific concerns, including: an aspect of the programming elements, such as recruitment, program space, and planning (14%); the transition to the updated strategies (14%); implementing the strategies with girls (7%); and implementing the strategies with mixed-gender groups (7%).

When asked if they had specific concerns about using the draft updated strategies while implementing existing *SciGirls* activities or media that were developed with the original *SciGirls Seven* in mind, only two educators shared a response, with one asking, “*How do we incorporate the new into the old? How can we repurpose the materials? Do you plan to provide new materials to drive educators to the connect website?*” and the other going somewhat off-topic to describe the limitations of their particular program in terms of storage space and computer access.

Sense of preparation and suggested support

The educators generally indicated that they felt very prepared to use the draft updated strategies in girls-only as well as mixed-gender settings. However, when asked if there was anything TPT might do or provide in order to help them feel more prepared to implement the *SciGirls Strategies*, about half of the educators shared a suggestion (46%). A third recommended TPT provide additional tips and examples (32%), including in the areas of working with mixed-gender groups, coordinating programs of different lengths, and incorporating culturally responsive teaching strategies. A tenth each suggested TPT facilitate connections between educators (11%) and/or provide additional trainings (11%), and less than one-tenth requested new activities (4%).

Educators’ suggestions relating to the *SciGirls Strategies*

Educators were invited to share revisions and additions to the draft *SciGirls Strategies* in their formative survey. They were also given an opportunity to “think outside the box” and share other recommendations related to the strategies as a whole, individual strategies, and/or the tips provided by TPT (in the *SciGirls Strategies and Tips* document) in an effort to leave open the possibility of changes to the *SciGirls Strategies* beyond updates or modifications. In response, one educator suggested a revision to the draft updated *SciGirls Strategies*, one shared a proposed addition, and three shared other recommendations. Given the relative lack of feedback shared in direct response to this survey question, the evaluation team reviewed each educator’s full set of survey responses to look for suggested revisions, additions, and recommendations. Summarized below, examples of all of the educators’ suggestions for the *SciGirls Strategies* are shared in depth in Part 6 of this evaluation.

Suggested revisions

Throughout their surveys, a few educators proposed revisions to the *SciGirls Strategies*, including rewording Strategies #2, #3, and #4 and clarifying aspects of Strategies #4 and #5.

Suggested additions

Throughout their surveys, three educators suggested TPT make specific additions to the updated *SciGirls Strategies*, including one who proposed incorporating a focus on critical thinking (a strategy that was removed in the transition from the original *SciGirls Seven*),

another who suggested incorporating language from the *SciGirls Seven* into Strategy #2 (specifically “hands-on and open-ended”), and a third who suggested expanding Strategy #3 to include critical feedback.

Other recommendations

Throughout their surveys, a number of educators shared other recommendations for the *SciGirls Strategies* or factors they thought the project team might want to keep in mind as they finalize the strategies. When sharing other recommendations, the educators commented on: aspects of Strategies #1, #2, and #4; the framework for strategy development; their interest in additional trainings or illustrations of the strategies in use; and how they might work with other educators to facilitate their transition to the updated strategies.

Additional observations for consideration in the forthcoming finalization of the *SciGirls Strategies*

This evaluation presents educators’ initial responses to the *SciGirls Strategies*. However, as a few educators noted, they may have more or different feedback after using the strategies in their Year 2 programs and/or observing how they are adopted by other educators in their *SciGirls CONNECT²* programs. As one educator explained, “I’m looking forward to seeing what strategies are most difficult to properly implement and what my colleagues find works best.”

As shown in Image 4 – moving into Phase 3 of the project, as partner organizations wrap up their Year 2 programming on a rolling basis – the evaluation team will focus on efforts to understand the impact of the draft updated *SciGirls Strategies* on educators and their programs. As they have done throughout the grant period, the evaluators will continue to share relevant information with the project and literature review

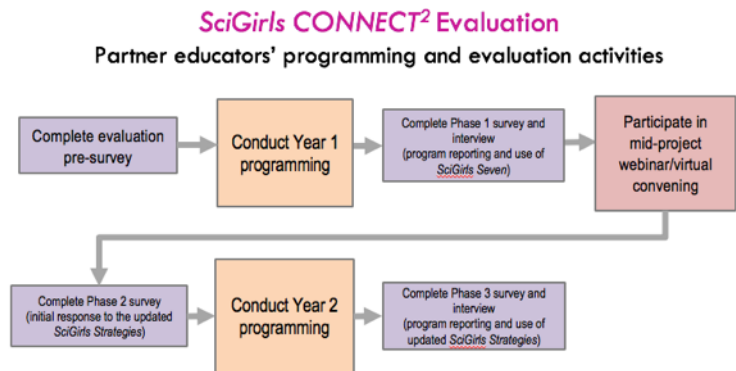


Image 4. Overview of partner educators’ evaluation activities

teams that may inform their scope of work as they finalize the updated *SciGirls Strategies* in the coming year. Areas that will be further explored through surveys and interviews at the end of Year 2 include questions considering the relative frequency with which educators use the updated strategies and why they may use some strategies more or less than others, as well as questions that will allow the evaluation team to compare educators’ Year 2 feedback on the updated strategies with their Year 1 feedback on the original *SciGirls Seven*, among other topics that will be addressed in an effort to help facilitate the project and literature review teams’ finalization of the updated strategies.

In the interim, the following observations from the current evaluation of educators’ initial responses to the draft *SciGirls Strategies* may also be of use, although caution should be taken in drawing broad implications from the findings, given that the evaluation relied on a relatively small sample of 28 educators from 16 partner organizations to provide feedback.

- When asked to describe the overall goal of the draft updated *SciGirls Strategies*, nearly three-fifths of the educators focused on one or more aspects of fostering girls' STEM identity (57%), as defined by the project and communicated to educators throughout *SciGirls CONNECT²: STEM identity integrates confidence, interest and motivation around STEM, and ultimately affects choices, behaviors, persistence and perceptions of STEM careers and STEM professionals*. Specifically, just under half of the educators pointed to a goal of increasing girls' interest in or motivation to pursue STEM careers (46%) while about one-tenth each mentioned increasing girls' confidence (14%) and/or increasing their interest in STEM topics (14%). Additionally, about a tenth of the educators used the phrase "STEM identity" in their responses (14%), indicating that, as a group, the educators may be more familiar with some of the impacts associated with the definition used by the project than the concept of STEM identity more broadly. As one educator acknowledged, "I know what STEM is, I'm just a bit unclear [on] STEM identity."

At the same time, developing girls' STEM identity wasn't the only goal identified by the educators. More than one-quarter thought the goal of the updated strategies was to make STEM personal or meaningful to girls (29%), while about one-fifth thought the goal was to incorporate cultural responsiveness (18%) and one-tenth shared miscellaneous goals (11%). Taken together, the range of responses point to some level of confusion among educators about the overall goal of the updated *SciGirls Strategies*.

As outlined in the *SciGirls Strategies and Tips* document shared in Appendix 1, "*the learning environment and culturally responsive teaching practices [aspects of the framework] are important in helping foster a STEM identity.*" Assuming that fostering girls' STEM identity is not only an outcome of the framework for strategy development, but also the primary goal of the updated strategies, it will be important to clearly convey this to the educators, particularly given that they may be accustomed to using the original *SciGirls Seven* with the (distinct) goal of engaging girls in STEM. As noted in Knight Williams' *Formative evaluation of educators' use of the SciGirls Seven strategies in Year 1*, this may prove somewhat easier among educators who are fresher to the strategies than those who have been working with them for years.

Finally – and again assuming that the goal of the updated strategies is to foster girls' STEM identity – given the range of the fields encompassed under the acronym of STEM, it may also be important to consider if and how the development of girls' STEM identity varies across disciplines, such as math, engineering, computer science, biology, and physics. As one educator noted, "*I've seen some interesting research about how success for women in physics often means developing a more masculine STEM identity. I'm all for girls getting to be their true selves in STEM, but I think the culture of STEM still has a long way to go before it will truly be accepting of women's true identities.*" Assessing the goal of the strategies through this lens may help the project and literature review teams pinpoint the anticipated impact(s) of the strategies on girls' STEM identity, as well as the specific way(s) in which each of the updated strategies contribute to the overarching goal of the updated *SciGirls Strategies*.

- Overall, the educators were enthusiastic about the inclusion of cultural responsiveness in the updated strategies and thought it would be moderately easy for them to utilize culturally responsive teaching strategies throughout their use of the updated *SciGirls Strategies*. However, throughout their surveys they consistently requested additional guidance from TPT on how to become a culturally responsive educator. As one educator explained, “... *I feel like I need to know more about what it takes to be a culturally responsive teacher. What cultures are we talking about? How do cultures differ? How does how I teach benefit or disadvantage students from specific cultures?*”

TPT’s [SciGirls Snapshot: Culturally Responsive Teaching](#) video featuring Dr. Alicia Santiago may be one way to help educators become more culturally responsive. This online video – which was shared as a link in the *SciGirls Strategies and Tips* document – guides educators through a series of self-reflection questions⁸ and outlines three steps they can take on their path to becoming a culturally responsive educator.⁹ Although educators’ awareness and use of this resource has generally not been a focus of the Year 2 post-program reporting conducted thus far, this may be a useful area for follow-up in the remaining post-program surveys and interviews. For example, one educator who has already provided feedback on her Year 2 program indicated that she was *not* familiar with this resource when she said, in response to an interview question about what TPT might do or provide in order to help her feel more prepared to implement the updated strategies, that she would “*love a video of Alicia giving ... tips on becoming a [culturally responsive educator].*”

In addition to this short, instructional video, educators’ feedback indicates that they might also appreciate further guidance in the form of a culturally responsive training, written resources, and additional video resources. For example, a few educators who have already provided feedback about their Year 2 programs suggested TPT create videos showing examples or scenarios “*where somebody was in a situation where something was uncomfortable ... and you have to adapt and learn from it ... [either a video of someone in the classroom, or someone recounting a situation, or even people acting a situation out].*”

- In general, the educators felt that the individual updated strategies complemented each other well and distilled complicated topics into distinct strategies (as in, “*Less repetitive [than the original SciGirls Seven] and thus easier to think about and discuss as distinct strategies*”). However, a few educators explained that they thought the language of Strategy #2 could be further simplified, and a couple suggested streamlining the language of the draft updated strategies more generally (as in, “*[I liked] that the SciGirls Seven strategies are brief which makes them easier to remember and continue to be conscious of when using them*” and “... *the extra verbiage makes integration of the [updated] strategies SEEM more daunting to someone unfamiliar with the mission of SciGirls. The new strategies incorporate lingo like ‘growth mindset’ that is not necessarily familiar to potential role models and may be intimidating*”).

⁸ Reflections questions in the *SciGirls Snapshot: Culturally Responsive Teaching* video include: Who are my students? What are their backgrounds? Are they similar to mine? How might my students’ traditions, values, beliefs, perceptions and situations differ from my own? How do I identify this diversity? Is it visible?

⁹ The three steps in the video are: understand your own culture and how it affects the way you relate to students, become aware of your own unconscious and implicit biases, and create an inclusive learning environment.

- Although a few educators requested tips or examples for using the updated strategies in mixed-gender groups, educators generally indicated that they felt very prepared to use the strategies in girls-only as well as mixed-gender settings. This sense of preparation seems to have been due, at least in part, to their familiarity with the concepts addressed in the draft updated strategies. For example, as two educators explained, *“I ... think these [updated] strategies are already a part of what we have been doing”* and *“As an educator some strategies seem like common sense or very common to all educational fields (i.e. connect to girls lives, using role models).”*

Additionally, when asked if they expected to face any barriers or challenges in their use of the draft updated strategies in their educational settings, no one issue stood out among the educators. About a tenth each shared concerns about the transition to the updated strategies (14%) and/or an aspect of the programming elements (14%), with other issues being cited by smaller groups of educators, indicating that the group generally wasn't concerned about using the *SciGirls Strategies* in their educational settings, again potentially in part because of their familiarity with the concepts addressed in the draft updated strategies. However, a few educators expressed concern that the transition might be challenging for *other* educators, as in: *“[Utilizing the framework for strategy development might be difficult if there are] other educators who lack adaptability. It may be difficult to move forward with a new way of thinking”* and *“Getting this across to our entire educator staff could also prove difficult depending on their open-mindedness and ability.”*

Taken together, these findings indicate that, when the strategies are finalized and shared more widely, the project team may want to follow these educators' suggestions by emphasizing the familiar aspects of the updated strategies (as done in the March 2018 webinar presenting the draft updated strategies, as shown in Image 5), and by highlighting the need for open-mindedness and flexibility among *SciGirls* educators. As one partner educator explained, *“I think we excel at ... the STEM aspects of the strategies (more reflected in the old strategies) but we will be putting more of an emphasis on the other aspects of the framework which we are less experienced with. I think we may have some pre-conceived notions of what ‘works’ and will need to be adaptive and learn as the program progresses.”*

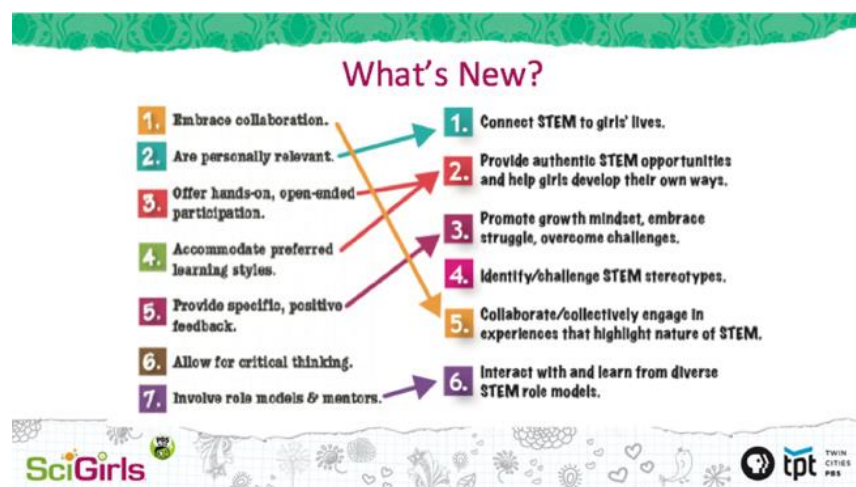


Image 5: Slide from the March 2018 webinar detailing the similarities and differences between the *SciGirls Seven* (on the left) and the draft updated *SciGirls Strategies* (on the right)

Appendix 1:

SciGirls Strategies and Tips and references

SciGirls Strategies and Tips - DRAFT
March 14th, 2018

Developing a STEM Identity

A gender gap continues to persist in the United States in which women are underrepresented in science, technology, engineering, and mathematics (STEM) fields. Women receive fewer degrees in computer science, engineering, physics, and mathematics and statistics than men and hold less than 30% of STEM jobs (NSF, 2017). The divide between genders begins in middle school at a time when girls are developing their own interests and recognizing their academic strengths, which often results in a shift away from STEM (Miller, Blessing, & Schwartz, 2006; Williams & Ceci, 2007). To prepare our girls for the 21st century workforce, it is crucial to reverse these trends. It is important to recognize that girls and boys do not display a significant difference in their abilities in math and science. The cause for the gender gap in STEM is social and environmental (Hill, Corbett, & St. Rose, 2010). Where gender differences consistently appear is in boys' and girls' interest and confidence in STEM subjects, starting at a very young age. This is where SciGirls can help.

Research suggests that developing a STEM identity is an important factor in girls choosing to participate in STEM courses, activities, and potentially careers. STEM identity refers to a person's sense of who they are, want to be, and what they believe they are capable of in relation to STEM. Girls' STEM identity development is dependent upon factors like interest, knowledge, self-confidence, performance and recognition (Aschbacher, Ing, & Tsai, 2014; Carlone & Johnson, 2007; Calabrese Barton, Kang, Tan, O'Neill, Bautista-Guerra, & Brecklin, 2014; Herrera, 2012; Leaper, 2015). SciGirls Strategies are designed to develop confidence and persistence, and to motivate girls towards developing a STEM identity during a crucial time in their academic and personal growth. The middle school years is when girls are deciding "what kind of girl to be" and figuring out desired versions of their future selves (Allen & Eisenhart, 2017; Carlone et al., 2015). This is when educators can help girls overcome barriers and push against stereotypical views to develop strong STEM identities. The identities girls author are shaped by how they see themselves and how others see them in multiple spaces including in-school and out-of-school, social, and home/family (Adams, Gupta, & Cotumaccio, 2014; Allen et al., 2017; Bricker and Bell, 2014; Carlone, Johnson, & Scott, 2015; Cervantes-Soon, 2016; Koch, Lundh, & Harris, 2015; Young, Young, & Capraro, 2017); across intersecting cultural characteristics including gender, race, ethnicity, and class (Bruning, Bystydzienski, & Eisenhart, 2015); and in relationship to concepts of femininity that are congruent with ideas of warmth, sensitivity, cooperation, and the need to belonging (Carlone et al., 2015; Diekman, Weisgram, & Belanger, 2015). When a girl sees STEM as being for her, she has confidence in her abilities, has strong STEM capital, and embraces and celebrates the differences which make her competitive in STEM (Tan, Calabrese Barton, Kang, & O'Neill, 2013; Cakir, Gass, Foster, & Lee, 2017; Dasgupta & Stout, 2014; Allen et al., 2017).

Setting the stage

In addition to the SciGirls Strategies themselves, research and practice highlight the need for educators to consider the *learning environment* in which the SciGirls Strategies are situated and to utilize *culturally responsive teaching practices* to engage and effectively serve all girls in STEM, especially girls of color and girls from marginalized communities. Both, the learning environment and culturally responsive teaching practices, are important in helping foster a STEM identity.

Create an inclusive learning environment

In order for the SciGirls Strategies to be as effective and impactful as possible, it is critical to provide a safe and inclusive learning environment that looks and feels inviting and allows girls to feel that they belong (Hubert, 2014; Sammet & Kekelis, 2016). Research shows that a learning environment that is comfortable, personally meaningful, collegial and supportive can positively impact girls' interest and motivation in STEM and positively influence girls' STEM identities (Cakir et al, 2017; Riedinger & Taylor, 2016; Adams et al, 2014). The learning environment must also be culturally responsive, one that recognizes, reflects, and validates students' history, cultures and world-views. In such an environment, diversity is valued as an asset, and validating the identity, culture, and language of the student is essential to effective teaching and learning.

Embrace diversity and foster inclusion

The population of the United States is becoming increasingly diverse and this diversity is reflected in our K-12 schools. By 2044, half of all Americans are projected to belong to a minority group resulting in a significantly more ethnically and culturally diverse population. For example one in four female students in public schools across the nation is Latina and, by 2060, that number will increase to one in three (Gandara, 2015). Therefore, the youth you work with may differ from you and each other in ethnicity, race, language and socio-economic background. To truly engage diverse girls in STEM, it is critical to reach out to them in ways that are culturally responsive and appropriate. Culturally responsive teaching (CRT) empowers girls by respecting and incorporating their interests, identities, cultures, backgrounds and experiences as central to the learning process (Gay, 2013; Ladson-Billings, 2008 & 2014; Sammet, et al., 2017, Scott & Zhang, 2014; Verdin, Godwin, & Capobianco, 2016; Civil, 2016). Culturally responsive teaching is particularly effective in motivating and engaging girls of color in STEM studies and careers as it recognizes girls' culture as an important strength upon which to construct the STEM learning experience (Hubert, 2014).

Become a culturally responsive educator

To become a culturally responsive educator, you first need to become aware of your own culture and understand that your background, knowledge, values, beliefs, and interests that shape who you are and how you interact with students. Engaging in self-reflection to identify thoughts, values, and behaviors about your own and other cultures, will allow you to better understand your racial and cultural identity and see how it differs from that of your students. Self-reflection will also help you recognize how your personal beliefs can influence your teaching and shape your students' concept of self. This helps you establish a learning environment that is responsive to the needs of ALL students. Developing self-awareness through self-reflection also gives you an opportunity to consider how your instruction might

be improved in order to empower students and enhance their learning. For help with self-reflection, check out these [reflection questions](#).

Culturally responsive teaching is defined *as a process of using cultural knowledge, prior experiences, and performance styles of diverse students to make learning more appropriate and effective for them* (Gay, 2000). Educators that learn about their students' backgrounds, interests, identities, and personal experiences, can use them as a tool to make connections for their students, making teaching more relevant to them. And SciGirls will help you to do just that. SciGirls empowers you to create a more gender equitable and culturally responsive STEM learning that inspires, engages, and help girls thrive in STEM. [Click here](#) to watch a video on CRT and becoming a culturally responsive educator.

Strategies

#1 Connect STEM experiences to girls' lives.

Make STEM real and meaningful by exploring issues or topics girls care about and impact their lives, families, or communities (Boucher, Fuesting, Diekman, & Murphy, 2017; Sammet et al., 2016). Engaging girls in activities that draw on their culture, interests, perspectives, needs, knowledge and lived experiences helps them to develop a STEM identity and increases their sense of belonging in STEM (Bonner & Dornerich, 2016; Erete, Pinkard, Martin, & Sandherr, 2016; Stewart-Gardiner, Carmichael, Latham, Lozano & Greene, 2013; Civil, 2016). Use culturally responsive teaching practices that leverage students' ways of knowing and meaning-making to meet the needs of diverse students, especially girls of color and girls from marginalized communities, and create opportunities for all students to see themselves as active participants in the scientific endeavor (Verdin, et al., 2016; Cervantes-Soon, 2016).

Tips:

- Connect a lesson or activity to girls' interests, culture and everyday lives. Ask girls about their backgrounds, community environment, interests, where they live, what they do after school, etc. If you are teaching girls about the physics of motion, ask them to share their knowledge or do a presentation about their favorite sports or hobbies. If girls are interested in food, you can use cooking as a way to teach them about proportions and fractions.
- Connect STEM to issues girls find compelling. Topics such as environmental and societal issues including public health, poverty, racism, and the power of media, are issues girls find compelling. Some girls might be personally affected by these issues. Ask girls what issues affect their lives and find links to your lesson. To infuse relevance into your biology curriculum, demonstrate the connection between biology and social issues. Present biological topics such as human genetics within their social contexts. For example, use the social history around the development of the molecular diagnostics for genetic disease and its use in screening programs in the United States as a way to teach biological concepts. Discuss social, ethical, legal issues associated with genetic testing of diseases such as sickle cell anemia, cancer, cystic fibrosis, etc.
- Have girls keep a journal (e.g. using smartphone applications) to connect STEM to their lives and experiences. Journal writing encourages girls to think about what they have

done, learned, and what they still need to know and do. It allows girls to connect what they learn to previous and daily life experiences. Journaling can promote critical thinking through cognitive processes such as prediction, brainstorming, reflection and questioning, and assesses girls' understanding.

#2 Provide authentic opportunities that mirror the practices of STEM and help girls develop their own ways of exploring and sharing knowledge.

Engage girls in hands-on, inquiry-based STEM experiences that incorporate practices used by STEM professionals, such as asking scientific questions, designing and conducting research, generating and testing hypotheses, and communicating results. It is important to create a space for girls to be active participants in the STEM process where their opinions, ideas and expertise are valued and they are able to develop their own ways of approaching problems and showing what they have learned. When girls take ownership of their own STEM learning and engage in meaningful STEM work, it positively impacts their perceptions of STEM fields, their identities, and re-defines what STEM is (Buckholz, Shively, Pepler, & Wohlwend, 2014; Kim, 2016; Scott & White, 2013; Farland-Smith, 2015; Munley & Rossiter, 2013; Civil, 2016; Riedinger et al., 2016).

Tips:

- Provide opportunities for girls to engage in meaningful hands-on STEM activities and develop skills without interfering. Activities should relate to what girls are studying and incorporate STEM practices used in the real world. Educators should use 'keep your hands in your pocket' approach to help increase girls' comfort with and confidence in STEM.
- Provide opportunities for girls to design their own investigation, analyze their own data and come to their own conclusions and suggest alternatives.
- Provide opportunities for girls to use everyday language to make sense of science terminology and use their language when you reiterate their points.
- Make direct connections between STEM activities and the work of STEM professionals so girls can see that what they are doing is real STEM work and envision themselves as someone who does STEM.

#3 Promote a growth mindset in girls to help them embrace struggle, overcome challenges, and increase self-confidence in STEM.

Girls' confidence and performance improves with a growth mindset and can be supported by specific, positive feedback on things they can control—such as the process, strategies, and behaviors. (Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 2000; Halpern, Aronson, Reimer, Simpkins, Star, & Wentzel, 2007; Kim, Wei, Xu, Ko, & Ilieva, 2007; Mueller & Dweck, 1998). Self-confidence can make or break girls' interest in STEM. Foster their efforts, support their strategies for problem solving, and let them know their skills can improve through practice. Celebrate the struggle. Wrestling with problems and having experiments fail is a normal part of the scientific process.

Tips:

- Communicate to girls that the material is confusing and challenging, and let girls know they can improve and succeed with effort and time.
 - Our brains can make new connections and get stronger with training and practice.
 - Teach that effort is part of the learning process and that intelligence not an innate ability that one is naturally born with.
- Promote and celebrate struggle by identifying that STEM is challenging and confusion is part of both the process of STEM and developing intelligence.
 - Support and extend girls' thinking by using probing questions that get a process of iteration rather than product.
 - Construct and pose problems that are rich in problem-solving strategies, are loosely defined, and/or have many possible solutions.
- Provide time and space for girls to grapple and work through ideas before stepping in to provide support and direction.

#4 Encourage girls to identify and challenge STEM stereotypes and bring their true selves to the learning space.

Acknowledge and explicitly counter existing stereotypes about who is capable of and who does STEM ensuring that doing STEM and being a STEM person do not contradict being feminine (Allen et al., 2017; Carli, Alawa, Lee, Zhao, & Kim, 2016; Cheryan, Master, & Meltzoff, 2015; Robnett, 2016). Support girls to push against existing stereotypes and the need to conform to gender roles (Allen et al., 2017; Carlone et al., 2015) by helping them make connections between their unique cultural and social backgrounds and STEM disciplines (Sammet et al., 2016, Scott, et al., 2014); support their individuality and their STEM-mindedness (Tan et al., 2013); and engage them in STEM experiences that have impact on their own interests and their lives outside of the classroom setting (Dasgupta et al., 2014; Verdin, et.al., 2016; Civil, 2016; Boucher, et al., 2017).

Tips:

- Help girls understand the stereotypical STEM professional (working alone on a computer or in a lab) is not what many women experience in their own work lives. These stereotypes turn girls off, before they have an opportunity to get turned on to STEM careers. Also emphasize compatibility of communal goals and STEM.
- Avoid terms such as “you guys”, “let’s geek out”, “get your nerd on” ... Let girls reclaim this language if they choose.
- Position girls to develop and draw upon communities of support (e.g., like minded individuals) and positive peer connections to counter gender bias that they may experience in STEM (Allen et al., 2017; Robnett, 2016).

#5 Develop opportunities for girls to collaborate and collectively engage in experiences that highlight the social nature of STEM.

Girls benefit from collaborative environments that recognize the need for a sense of group membership or collective community (Capobianco, Ji, & French, 2015; Diekman et al., 2015; Leaper, 2015; Riedinger et al., 2016; Robnett, 2013), especially when they can participate and

communicate in collegially nurturing safe spaces (Parker & Rennie, 2002; Scantlebury & Baker, 2007; Werner & Denner, 2009). These spaces should be inclusive and equitable, positioning girls to consider and explore their own perspectives and the diverse perspectives of others offer opportunities to build relationships and a collective identity (Cakir et al., 2017; Sammet et al., 2016). Highlighting the social nature of STEM and communal opportunities in STEM disciplines can increase interest and motivation in these fields and change the stereotypic perceptions that STEM fields are less communal than other fields (Boucher, et al., 2017; Clark, et al., 2016; Leaper, 2015).

Tips:

- Create a safe, nurturing environment accessible to *all* girls by acknowledging and respecting girls' learning preferences and styles of participation, and by communicating to them that we all take in and process information in our own unique ways and we are entitled to be who we are. This will help you develop a learning environment in which girls feel free to be themselves and share ideas, question assumptions, and construct meaning collaboratively, reinforce or provoke discussion and be reassured by each other.
- Provide explicit links between STEM activities or investigations and the communal goals and values of STEM professions. For example, during a lesson about water resources and water transportation, link the lesson to relevant STEM careers such as civil engineering, and design an activity that helps girls recognize the impact that civil engineers have on society. Have a discussion about the communal goals and values that could be linked to the activity such as transporting water with low-cost materials - which is particularly relevant to developing countries, safety, and environmental impacts.
- Encourage girls to work together to produce knowledge by having them work in small collaborative groups. Help girls understand the benefits of collaboration and what successful collaboration looks like. To enhance their learning, let girls explore the relationship between the lesson or activity and their personal and social experiences. Give students ownership in the process by designing meaningful team roles that intellectually engage each girl (e.g. manager, leaders for each subtask); and make sure to establish expectations and norms for working together.

#6 Provide opportunities for girls to interact with and learn from diverse STEM role models

Role models who have diverse backgrounds, experienced different career pathways, and succeeded in the varied careers available in STEM help girls break down stereotypes and develop STEM identities by increasing interest in and positive attitudes toward STEM, strengthening self-conception and by developing a feeling of belonging (Koch et al., 2015; Leaper, 2015; Adams et al., 2014; Jethwani, Memon, Seo, & Richer, 2017; Kessels, 2014; O'Brien, Hitti, Shaffer, Van Camp, Henry, & Gilbert, 2016; Levine, Serio, Radaram, Chaudhuri, & Talbert, 2015; Hughes, Nzekwe, & Molyneaux, 2013). When girls can relate to role models as multidimensional people with diverse lived experiences, which include helping and collaborating with others and the integration of family and STEM careers (Cheryan et al., 2015; Weisgram & Diekman, 2017) they develop a broader mental picture of what it looks like

to be a STEM person and expand their vision of what's professionally and personally possible in their own lives.

Tips:

- Invite role models who are encouraging, supportive, engaging, interesting, and relatable; who mirror the diversity in our populations; and who represent the different levels (e.g., high school, undergraduate, and graduate) and the range of opportunities available in STEM education and careers (e.g., teachers, outreach specialist, scientists).
 - Have role models describe their work directly to girls, have them lead an activity, or have them develop a mentor-pair relationship with a girl or group of girls. If you are unsure of their comfort level working with children, pair them with other educators or leaders and/or share SciGirls Role Model Strategies (http://www.scigirlsconnect.org/wp-content/uploads/2016/05/SciGirls_RoleModel.pdf).
 - Use SciGirls episodes or our female role model profiles (http://www.scigirlsconnect.org/resource_topic/role-model-profiles/) to showcase the work of girls and women in STEM and to supplement the role model component of your program.
- Encourage role models to describe their career path; what their work looks like; how their work benefits others; and how they integrate their professional selves with their personal lives including such things as hobbies, interests, and families.
 - Invite role models to specifically address the struggles and barriers that they had to overcome or continue to experience in their professional lives and between their professional and personal lives.

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