SciGirls CONNECT²

Formative evaluation report

Educators' use of the draft updated
***SciGirls Strategies* in Year 2**

(*SciGirls CONNECT²* Phase 3)

Knight Williams, Inc.

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

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Significant findings

The independent evaluation firm Knight Williams, Inc. conducted a formative evaluation during Year 2 of the *SciGirls CONNECT²* program in order to gather information about the partner educators' use of, reflections on, and recommendations relating to the draft updated *SciGirls Strategies*. The evaluation aimed for two educators from each of 14 partner organizations – specifically the program leader and one educator who was familiar with the original *SciGirls Seven* – to provide reflections on their use of the draft *SciGirls Strategies* in their programs through an online survey and follow-up interview. In all, 25 educators from 13 partner organizations completed the survey, for a response rate of 89%, and all but two of these educators went on to complete the follow-up interview.

There was a considerable range in the number of years the *SciGirls CONNECT²* educators had worked at their organizations, been involved in STEM education, and implemented STEM programming for girls, in each case ranging from a year or less to more than 10 years. Two-fifths of the educators indicated that they had a year or less of experience with any *SciGirls* strategies (the *SciGirls Seven* and/or the draft *SciGirls Strategies*), while remaining educators had two or more years of experience.

A brief overview of the extent to which the partners fulfilled the *SciGirls CONNECT²* program requirements is provided below, followed by a summary of key findings that emerged regarding educators' use and perceptions of the draft *SciGirls Strategies* in their programs.

Fulfillment of SciGirls CONNECT² program requirements: Looking across the program reporting information provided by the partners, the evaluation confirmed that most organizations implemented the minimum required elements listed on the [partner website](#) with respect to: serving at least 10 girls ages eight to 13; implementing at least 16 hours of programming; and including three female role models/STEM professionals, a family event, and video creation. Two partners did not quite reach the expectations with respect to the minimum number of hours, three did not meet the expectations with respect to the minimum number of girls, and another three partners had fewer than three participating STEM professionals. Additionally, three each did not host a family event or incorporate video creation. About half of the partners met <u>all</u> of the program requirements.

Feedback on the SciGirls Strategies as a whole: Overall, the draft *SciGirls Strategies* were well received. The educators generally: liked the strategies; found them well organized, clear/easy to follow, and cohesive; felt the strategies met their expectations; thought the strategies were easy to use; thought it had been easy to shift their thinking from the mindset of the *SciGirls Seven*; anticipated they would use the strategies in their next informal STEM program for girls; and thought they would recommend the strategies to other educators.

Feedback on the framework for strategy development: The educators generally thought they found all four aspects of the framework for strategy development *very clear*: the learning environment, culturally responsive teaching, STEM identity, and how the framework supports use of the strategies. Reflecting on their programs, they also generally thought it had been *moderately easy* for them to consider the learning environment, utilize culturally responsive teaching strategies, and focus on STEM identity throughout their use of the draft updated strategies.

Use of the SciGirls Strategies: The educators generally indicated that they used each of the six strategies to *a considerable extent* or *a great extent*. The majority of educators who commented on specific strategies they had used to *a great extent* pointed to Strategy #6, perhaps highlighting an enthusiasm for incorporating diverse STEM role models into their programs. The majority who commented on strategies used *to a considerable extent* or less pointed to Strategy #4, potentially indicating that some educators found that strategy somewhat more difficult to incorporate.

Perceived value of and comments about the individual SciGirls Strategies: The educators generally found each of the six strategies *very* or *extremely valuable* as applied in their programs. At the same time, two-thirds of the educators commented on challenges they encountered using Strategy #4 and/or gave suggestions for how TPT might revise or support their use of this strategy. Meanwhile, smaller groups (of one-tenth to one-quarter each) shared concerns about the other five strategies, again commenting on challenges faced or offering suggestions for how TPT might revise or support their use of each strategy.

Perceived clarity of the individual SciGirls Strategies: The educators generally thought they found each of the six strategies *extremely clear*.

Perceived goal of the SciGirls Strategies: The educators were somewhat divided when asked to identify the goal of the updated strategies, with half of the educators citing more than one goal. Half thought the goal was to foster girls' STEM identity. About two-fifths pointed to the goal of fostering girls' STEM interest or engagement, and smaller groups said they thought the goal was to showcase diversity in STEM, foster STEM confidence, or foster independent/individual thinking, among other responses.

Among the 11 educators who correctly identified the overall goal of fostering girls' STEM identity, nine said they thought this goal had been met in their programs. When asked what they did that helped in achieving this goal, six of these educators commented on their use of Strategy #6 and one or two each pointed to: their use of Strategies #1, #3, #4, and #5; how they had considered the learning environment; how they presented STEM in a new or different way; or how they gave girls a voice. Meanwhile, two educators said they thought the goal of fostering girls' STEM identity was only partially met in their programs. When asked if there was anything they *didn't* do that might have helped in this respect, one educator said they could have done more to incorporate Strategy #6 and another felt they had not had enough time with their girls.

How the SciGirls Strategies were considered in planning and implementation: The educators were somewhat divided in how they considered the strategies in the planning and implementation of their programs. Two-fifths said they prioritized one or more strategies consistently, one-third said they used the strategies synergistically or as a set, and one-quarter described using different strategies in different situations.

Among the 11 educators who correctly identified the goal of the strategies as fostering girls' STEM identity, four used the strategies synergistically or as a set, four prioritized one or more strategies consistently, and three described using different strategies in different situations. Nine of these educators went on to explain that they thought their approach (of using the strategies synergistically (4), prioritizing one or more strategies consistently (2), or using different strategies in different situations (3), respectively) helped facilitate the goal of fostering girls' STEM identity. The two remaining educators (who both prioritized one or more strategies consistently) felt that the goal of fostering girls' STEM identity was only partially met in their programs. When asked if they thought their approach to the strategies helped contribute to any challenges faced in meeting this goal, both educators said no.

Perceived effectiveness of the SciGirls Strategies: Educators generally found the strategies *very effective* in impacting the four main areas that TPT envisioned, specifically: engaging girls from diverse racial/ethnic and socioeconomic backgrounds in a culturally responsive way, facilitating girls' STEM identity, helping them address teaching challenges, and helping them reflect on or modify their teaching practices.

Whether educators thought the SciGirls Strategies facilitated changes in girls' STEM interest, self-confidence, and motivation: Nearly all of the educators thought the strategies facilitated changes in girls' interest in STEM, while smaller groups – but still the majority in each case – thought the strategies facilitated changes in girls' self-confidence and motivation in STEM. Just under half of the educators said they thought the strategies facilitated changes in all three areas (girls' STEM interest, self-confidence, *and* motivation), which together contribute to STEM identity, as defined by the project.

In terms of specific strategies that impacted girls' interest in STEM, half of the educators pointed to Strategy #6 and a third pointed to Strategy #2, with other strategies being cited by groups of about a fifth or less. In terms of specific strategies that impacted girls' self-confidence in STEM, about half each pointed to Strategies #3 and #5, with other strategies being cited by groups of about a tenth or less. Finally, in terms of specific strategies that impacted girls' STEM motivation, about a third each pointed to Strategies #5 and #3, with other strategies being cited by groups of about a fifth or less.

Most useful resources for implementing the SciGirls Strategies: When asked which resources they found most useful in helping them implement the strategies, four-fifths of the educators pointed to the *SciGirls* activities, with a few explaining that they thought these resources aligned to the strategies. Smaller groups of approximately one-half each cited the episodes or clips from episodes, the women in STEM videos, and/or the CONNECT website, among other responses.

Perceived value of materials provided to facilitate use of the SciGirls Strategies: Educators who indicated that they had used each of the following preparatory materials generally found them *very valuable*: the *SciGirls Strategies and Tips* document, the references document, the webinar introducing the strategies, the webinar/office hours about the strategies, and the chart showing the relationship between the original and draft strategies.

Anticipated barriers or challenges in using the final SciGirls Strategies: When asked if they expected to face any barriers or challenges in using the final version of the updated strategies, no one issue stood out among the educators. One-third declined to answer the question and a quarter said they had no concerns. About a fifth each shared implementation challenges and/or anticipated they might encounter challenges in using the strategies with other youth, including youth: of different ages, with different levels of STEM experience, and in mixed-gender groups.

Suggested support to help implement the final SciGirls Strategies: When asked what TPT might do or provide to help them feel more prepared to implement the final *SciGirls Strategies*, about three-quarters thought they might provide or update specific resources, for example making graphics for each strategy or tip that could be shared on social media, providing benchmarks for future *SciGirls* programs, and creating printed and online guides aligned to the updated strategies. Additionally, two-fifths each requested trainings and/or examples or tips for using the strategies, among other responses.

Suggested revisions, additions, and other recommendations: Throughout their surveys and follow-up interviews, a number of educators proposed revisions to the draft *SciGirls Strategies*, including rewording Strategy #4 and clarifying aspects of Strategies #4 and #5. Six educators suggested TPT make additions to the strategies: one recommended incorporating language from the *SciGirls Seven* into Strategy #2; another proposed incorporating a focus on critical thinking (a strategy that was removed in the transition from the original *SciGirls Seven*); a third suggested adding a focus on local STEM professionals to Strategy #6; and three proposed other additions to the set of strategies. Finally, a number of educators shared other recommendations for the *SciGirls Strategies* or factors they thought TPT might want to keep in mind when finalizing the strategies. These educators commented on: Strategies #1, #3, and #4; STEM identity; culturally responsive teaching strategies; and the presentation of the final *SciGirls Strategies*.

Suggestions for incorporating cultural responsiveness: When asked how TPT might (better) incorporate cultural responsiveness throughout the strategies and/or the framework for strategy development, more than a quarter said they thought the strategies and/or framework should emphasize the importance of listening to and connecting with youth and families. About a fifth commented on using culturally responsive teaching with Strategy #6, and smaller groups requested examples or tips, thought cultural responsiveness had more to do with the leader(s) than the strategies, or shared other responses. Finally, about a third of the educators instead described ways they thought cultural responsiveness could be incorporated into (existing and suggested) *SciGirls* resources.

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 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* and draft updated *SciGirls Strategies* 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 listed above: **evaluate educators' use and perceived effectiveness of the *SciGirls Seven* and draft updated *SciGirls Strategies* with diverse girls in informal STEM settings**. The evaluation entailed gathering feedback from experienced *SciGirls* educators at four key project milestones, including before and after they implemented the original *SciGirls Seven*, and then both after they reviewed and subsequently implemented the draft updated *SciGirls Strategies*. To capture the educators' experience in real time, and to inform TPT's efforts to revisit and update the *SciGirls Seven* and related strategies, the evaluation team relied on an iterative process that required flexibility in responding to each partner's unique start and end dates, as well as an ongoing collaboration with the strategy development, literature review, and research teams.

Role of the outreach partner organizations

Incorporate and provide feedback on the *SciGirls Strategies*
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 and provide feedback on their use of the original and draft updated strategies in their *SciGirls* outreach programs. In Year 1 (April-December 2017) they focused on the original *SciGirls Seven* and in Year 2 (April-December 2018) they focused on a draft version of the updated *SciGirls Strategies.*

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[1] Two partner organizations were unable to complete the Year 1 requirements and were thus replaced in early 2018 by two new partner organizations.

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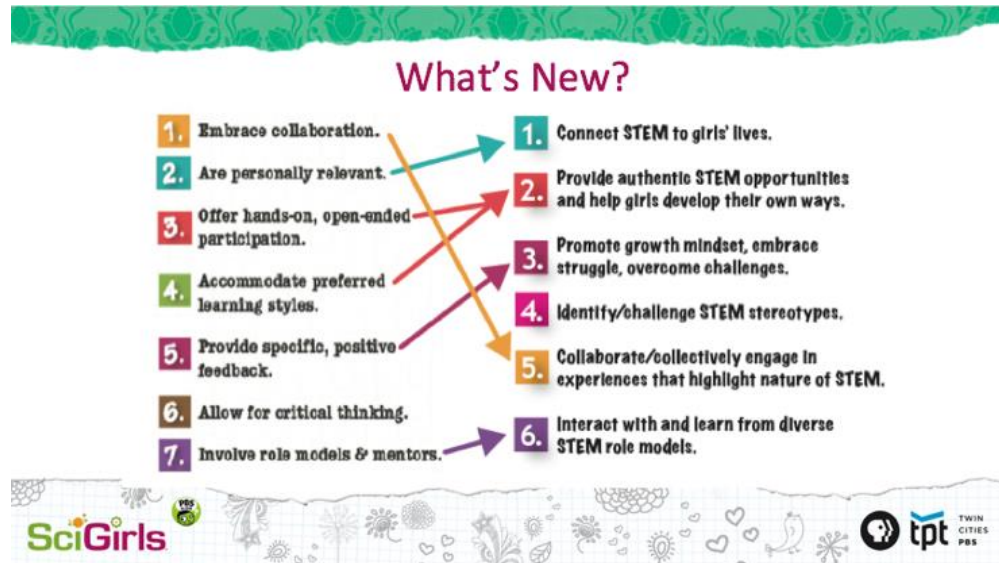
Image 1: Slide from the March 2018 webinar detailing the similarities and differences between the *SciGirls Seven* (on the left) and the draft updated *SciGirls Strategies* (on the right)

Incorporate *SciGirls* program components
In addition to addressing the *SciGirls Strategies* as outlined above, the partner organizations were required to include several program components outlined on the [*SciGirls CONNECT²* website](#), including:

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

Role of independent evaluation

The role of the independent evaluation during the three-year project period has been "*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:

1) provided 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) provided ongoing documentation and assessment of *SciGirls CONNECT²* project activities to help assess progress in achieving the grant's stated objectives.

As shown in the flowchart below, educators assisted in this effort by providing program information and feedback on their use of the original and draft updated strategies at four points over the grant period through a series of online surveys, follow-up interviews, and program reporting.

SciGirls CONNECT² Evaluation
Partner educators' programming and evaluation activities
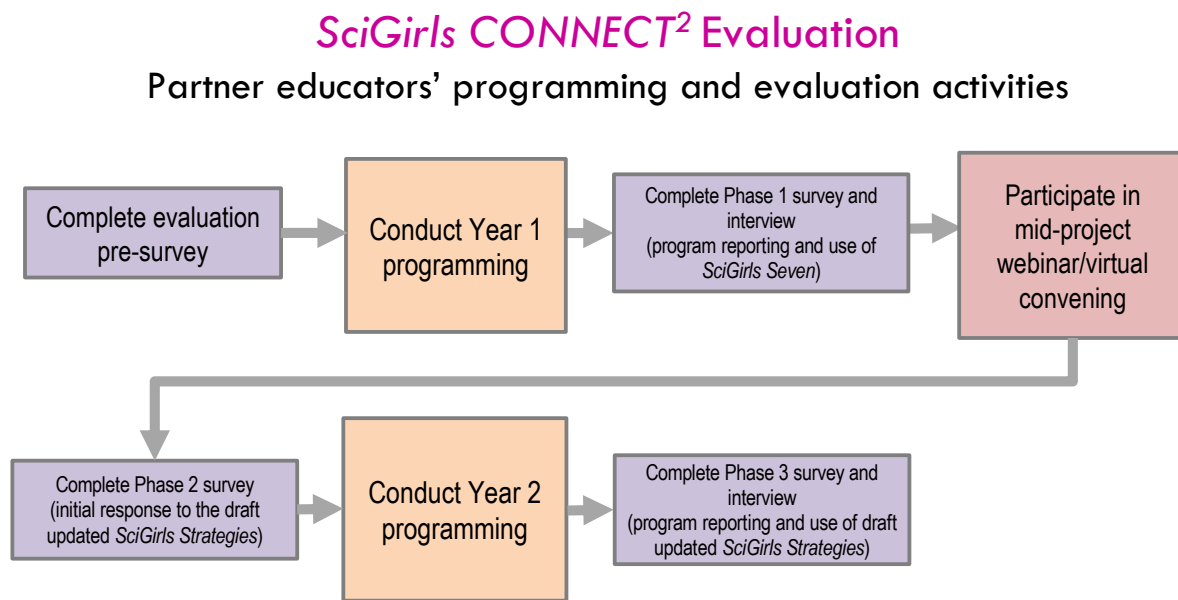
This report focuses on Phase 3 of the formative evaluation, shown in the bottom right box of the flowchart. The purpose of the evaluation at this stage of the project was to gather information about the educators' use of, reflections on, and recommendations relating to the draft updated *SciGirls Strategies*, to help inform the final version of the strategies.

Method

As the partners completed their Year 2 programs, between April and December of 2018, Knight Williams sent them an invitation to complete an [online survey](#) hosted on the firm's independent server.[2] The evaluation aimed for two educators from each partner organization – specifically the program leader and one educator who was familiar with the *SciGirls Seven* – to complete the survey.

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[2] Note that all findings presented in the report relate to these Year 2 programs.

After submitting their surveys, each educator was asked to schedule a follow-up phone interview with a member of the evaluation team. Depending on the depth of their feedback, interviews lasted 20-45 minutes, with most taking 20-30 minutes.

Analysis

Basic descriptive statistics were performed on the quantitative data generated from the evaluation. Content analyses were performed on the qualitative data generated in the open-ended questions. The analysis was both deductive, drawing on the project's goals and objectives, and inductive, looking for overall themes, keywords, and key phrases. All analyses were conducted by two independent coders. Any differences that emerged in coding were resolved with the assistance of a third coder.

Response rate

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

Survey response
The evaluation aimed for two educators from each of the 14 partner organizations that completed programs to complete the formative survey, for a total of 28 educators. In all, 25 educators completed the survey, for a response rate of 89%. Twelve partner organizations submitted two surveys each, and one organization submitted one survey. Despite multiple requests from the evaluation team and TPT, both educators from the remaining partner organization were unresponsive, resulting, as noted above, in 13 rather than 14 partner organizations being represented in this report.

Follow-up interview response
In all, 23 of the 25 educators who submitted the formative survey went on to complete the follow-up interview, for a response rate of 92%. Ten (10) partners had two educators complete their follow-up interviews, and three partner organizations were represented by one.

Background

This Background section is divided into four parts. The first provides an overview of the partner programs with respect to location, program types, settings, length, duration, STEM topics, resources used, and inclusion of components relevant to *SciGirls CONNECT²*. The second provides an overview of the program participants, including the number and background of participating youth and the inclusion of other participants, specifically family members and in-person STEM professionals. The third considers the background and experience of the programs' participating educators, how these educators characterized their desired program impacts, and whether and how they felt these impacts were realized. The fourth examines if and how partners met the Year 2 *SciGirls CONNECT²* program requirements.

Program characteristics

Program locations
Image 2 shows where the *SciGirls CONNECT²* programs were held. The programs took place in 10 different states across the United States and the District of Columbia. Seven programs were based in East coast states, and three took place in the Minneapolis-St. Paul region.

Image 2. *SciGirls CONNECT²* program locations

Program types and settings
Table 1 shows that the two main program types implemented by the partners were afterschool programs and summer camps. The partner programs were held in various settings, most often schools, though a few programs were held in a museum/aquarium/science center, a community center, or another location, specifically a public library and a Girl Scouts facility.

Program length and duration
As shown in Table 1, the partners hosted programs that ran from as short as two days to as long as five months. Total program hours ranged from seven to 50, averaging 29 hours per partner. The number of program sessions ranged from two to 29, averaging 10 sessions per partner, with the sessions ranging in length from one to 10 hours, averaging four hours per session.

Table 1. *SciGirls CONNECT²* program structure (N=13)	
Program types and settings	
Types	Afterschool: 7 Summer camp: 5 Spring break camp: 1
Settings	School: 7 Museum/aquarium/science center: 3 Community center: 2 Other: 2
Program length and duration	
Shortest and longest programs	Shortest: 2 days Longest: 5 months
Total program hours	Range: 7-50 Average: 29
Sessions per program	Range: 2-29 Average: 10
Session length	Range: 1-10 hours Average: 4 hours

STEM topics

Figure 1 shows the STEM topics that the partners said they incorporated into their programs. All of the programs focused on science and most also focused on engineering, technology, and/or math. Several programs focused on art while a few focused on computer programing, citizen science, and other topics, specifically "*natural resources*" and healthy living.

Figure 1: STEM topics incorporated (N=13)

Number of programs

Topic	Number of programs
Science	13
Engineering	12
Technology	11
Math	10
Art	8
Programming	5
Citizen science	4
Other	2
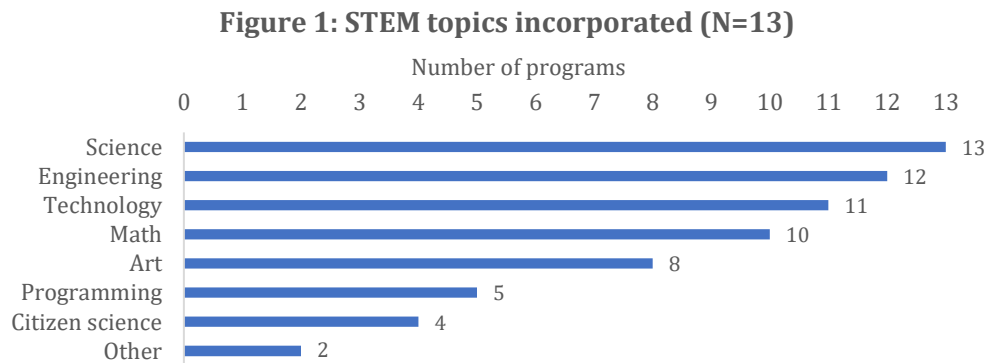
Use of SciGirls resources

Figure 2 shows the resources that the partners said they used in their programs. All of the programs used the *SciGirls* activities, while most also used episodes or episode clips, women in STEM videos, and/or the CONNECT website. Additionally, several programs used the PBS Kids website. Individual partners used the PBS Parents website or other resources, including "*handouts*," "*FabFems*," "*SciGirls Code*," and "*coding and other programs to include Makey Makey*."
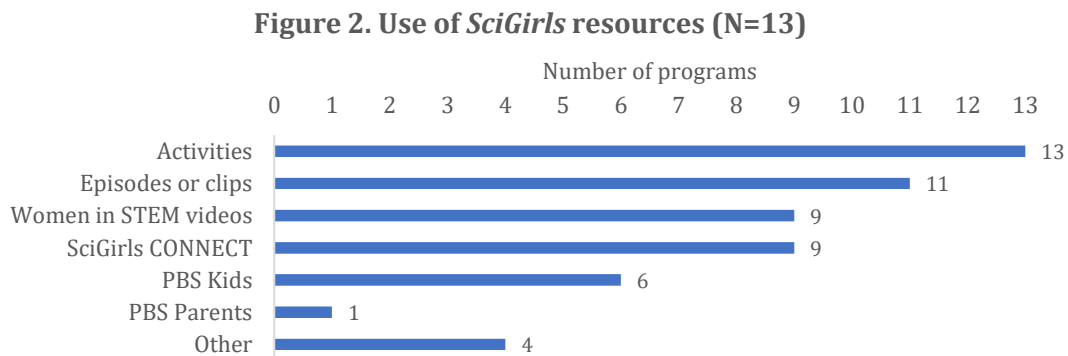
Figure 2. Use of *SciGirls* resources (N=13)

Number of programs

Resource	Number of programs
Activities	13
Episodes or clips	11
Women in STEM videos	9
SciGirls CONNECT	9
PBS Kids	6
PBS Parents	1
Other	4

Incorporation of components relevant to SciGirls CONNECT[2]

Figure 3 on the following page shows the extent to which the partners reported that their programs included eight components relevant to *SciGirls CONNECT[2]*, based on a scale from 1.0 (*not at all*) to 5.0 (*to a great extent*). As reflected in the median ratings, overall, the partners indicated that their programs incorporated some components more than others. In general, they thought the programs had exposed youth to STEM role models to *a great extent*. They also thought the programs had generally incorporated five components to *a considerable extent*: integrating the draft updated *SciGirls Strategies*, focusing on enhancing youths' STEM identity, addressing youths' knowledge about STEM fields, showing culturally and linguistically relevant STEM media, and including opportunities for youth-created videos.

Finally, they thought the programs generally offered opportunities for family participation to *some extent* and addressed parents/guardians' knowledge about STEM fields to *a little extent*.

Figure 3. Median ratings of the extent to which partners said their programs incorporated components relevant to *SciGirls CONNECT²* (N=13)

Scale from: 1.0 (*not at all*) to 5.0 (*to a great extent*)

Expose youth to STEM role models	5.0
Integrate the draft updated SciGirls Strategies	4.0
Focus on enhancing youths' STEM identity	4.0
Address youths' knowledge about STEM fields	4.0
Show youth culturally and linguistically relevant STEM media	4.0
Include opportunities for youth-created videos	4.0
Offer opportunities for family participation	3.0
Address parents/guardians' knowledge about STEM fields	2.0

Program participants

Types of communities drawn from
Ten (10) of the 13 partners reported that their programs drew youth from urban communities, while six pointed to suburban communities, and three to rural communities.

Youth demographics and background information
Table 2 summarizes basic demographic and background information for the 182 youth that the 13 partners reported as having participated in their programs.

Based on the partner reporting, nearly all of the youth were girls and the majority were in grades six through eight. A third of the youth were White, a third were African-American/Black, and more than a tenth were Hispanic or Latino.

Table 2. Demographics and background information of youth participants (N=182)	
Gender	Girls: 95% Boys: 5%
Grade level	Grades 3-5: 37% Grades 6-8: 62% Grades 9-12: 1%
Racial/ethnic background	White: 36% African-American/Black: 35% Hispanic/Latino: 16% Multiracial: 7% Asian: 3% Native American: 2%

Barriers to STEM engagement
Figure 4 on the following page shows the number of partners who said that *all*, *most*, *some*, or *none* of the youth in their programs faced the seven STEM barriers depicted in the chart. These barriers were among those described in the NSF project proposal as the types of barriers preventing many girls, especially girls from minority and lower socioeconomic groups, from fully participating in STEM studies and career paths (NSF proposal, 2015).

Figure 4. Partners' assessment of youths' barriers to STEM engagement (N=13)

Number of programs

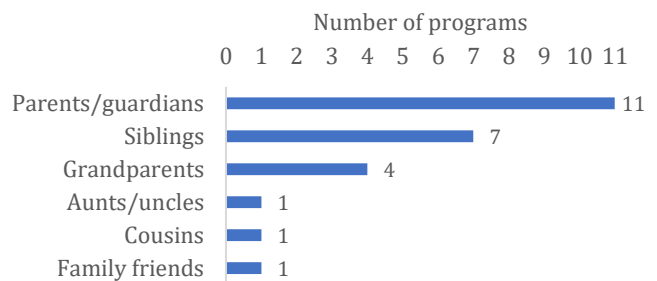| Barrier	All	Most	Some	None	DK
Low exposure to STEM role models and mentors	2	4	6		1
Low-to-moderately-low socioeconomic status	2	4	5		2
Families that were non-STEM identifying		4	7		2
Low parental/guardian knowledge of STEM fields	1	3	7		2
Low knowledge of STEM fields	1	2	9		1
Low parental/guardian English language proficiency			6	5	2
Low English language proficiency			3	10	

■ All ■ Most ■ Some ■ None ■ DK

Focusing on the partners who thought *most* or *all* of their youth faced each barrier:

- Nearly half of the partners thought *most* or *all* of their youth had low exposure to STEM role models and mentors, while a group of the same size thought *most* or *all* of their youth were of low-to-moderately-low socioeconomic status.
- A few partners thought *most* of their youth had non-STEM identifying families.
- A few partners thought *most* or *all* of their youth had parents/guardians with low knowledge about STEM fields. A few also thought *most* or *all* of their youth had low knowledge about STEM fields.

Family members

Figure 5 shows the other types of individuals (beyond youth) that participated in some aspect of the partner programs. All of the 11 partners who shared a response pointed to the presence of parents. More than half mentioned siblings and a few pointed to grandparents. Aunts or uncles, cousins, and/or family friends were mentioned by one partner each.

Figure 5. Programs that involved family members (n=11)

Number of programs

	Number of programs
Parents/guardians	11
Siblings	7
Grandparents	4
Aunts/uncles	1
Cousins	1
Family friends	1

In-person STEM professionals

Figure 6 shows the number of in-person STEM professionals who participated in the programs. The number ranged from a low of one to a high of 24, and averaged six per program. Nearly half the programs included three to five STEM professionals, while the remaining programs included either fewer or more STEM professionals.

Figure 6. Number of STEM professionals participating in programs (N=13)

Number of programs

	Number of programs
1 or 2 STEM professionals	3
3 to 5 STEM professionals	6
6 to 9 STEM professionals	1
10 or more STEM professionals	3
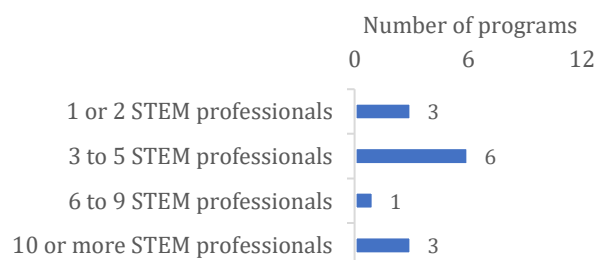
### How STEM professionals participated

Figure 7 shows how the STEM professionals participated in the programs. In most programs, they gave presentations or held Q&As and/or led or assisted with activities or lessons. In a few cases they led a field trip or tour and/or participated in other ways, such as sitting with students during lunch and "*creating a video to share with parents.*"

Figure 7. How STEM professionals participated in the programs (N=13)

Number of programs

|	Number of programs
Presentations/Q&As	9
Led/assisted with activities or lessons	9
Led field trip or tour	3
Other	2
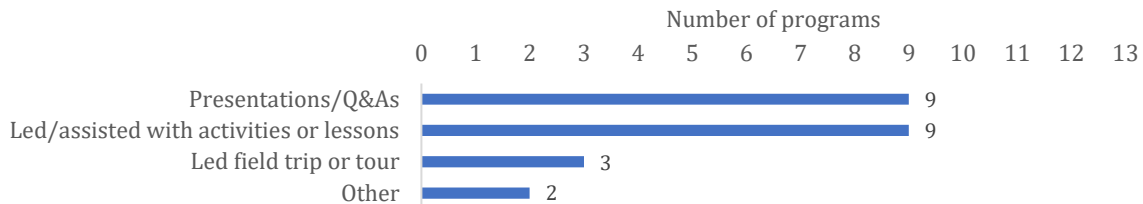
Partner educators' backgrounds and perceived program impacts

Role at organization

Figure 8 shows the educators' roles at their organizations. More than half identified as program leaders, while slightly less than half identified as educators. Thus, in a few cases, the role of program leader seems to have been shared by two individuals from the same organization.
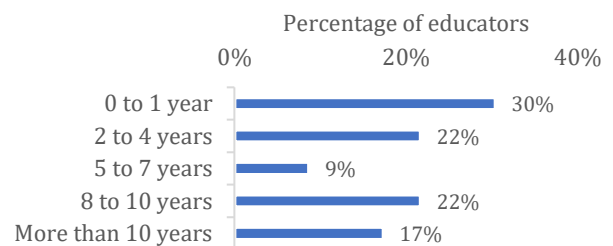
Figure 8. Educators' roles at their organizations (N=25)

Educator, 44%
Leader, 56%
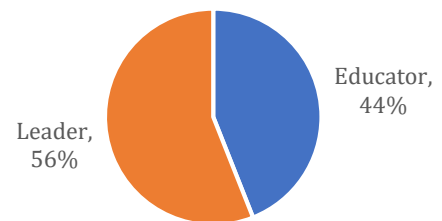
Experience at organization

Figure 9 shows the educators' years of experience at their organizations, for whom this information was available (23/25). About half of the educators indicated they had five or more years of experience, while half had less than five years' experience.
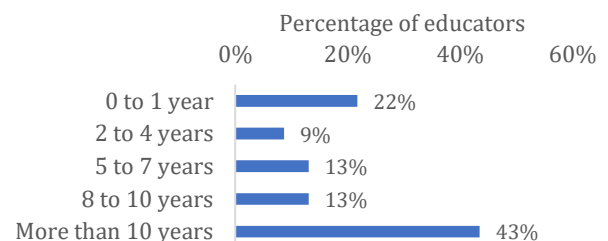
Figure 9. Educators' experience at their organizations (n=23)

Percentage of educators

	Percentage of educators
0 to 1 year	30%
2 to 4 years	22%
5 to 7 years	9%
8 to 10 years	22%
More than 10 years	17%

Experience in STEM education

Figure 10 shows the number of years the educators' had working in STEM education, for whom this information was available (23/25). The largest group, more than two-fifths, had more than 10 years of experience, while the second largest group, one-fifth of the educators, had a year or less of experience. Smaller groups of educators had two to four years, five to seven years, or eight to 10 years of experience in STEM education.

Figure 10. Educators' experience in STEM education (n=23)

Percentage of educators

	Percentage of educators
0 to 1 year	22%
2 to 4 years	9%
5 to 7 years	13%
8 to 10 years	13%
More than 10 years	43%

Experience engaging girls in STEM
Figure 11 shows educators' years of experience engaging girls in STEM, for whom this information was available (23/25). Just over half of the educators had five or more years of experience, while just under half had less than five years of experience.

Experience using the SciGirls Seven and/or the draft SciGirls Strategies
Figure 12 shows educators' experience using the *SciGirls Seven* and/or the draft *SciGirls Strategies*, for whom this information was available (23/25). About two-fifths each said they had a year or less or five to eight years of experience, while about a fifth had two to four years of experience with the strategies.

Impacts educators hoped their programs would have on participating girls
Figure 13 shows the main impacts educators hoped their programs would have on participating girls. Though they shared a range of desired impacts, the educators most often said they hoped to expose girls to STEM careers or encourage them to consider STEM careers, with this impact being mentioned by three-fifths of the group. Two-fifths of the educators focused on increasing girls' awareness/knowledge of STEM and its applications, while one-third pointed to increasing girls' interest or excitement in STEM. Smaller groups of less than one-fifth each wanted their programs to increase girls' confidence, increase girls' problem-solving skills and comfort, help girls build their collaboration skills, and/or shared other desired impacts, such as "*[having] parents be more involved*" and "*[trying] new activities.*"

Figure 11. Educators' experience engaging girls in STEM (n=23)

Percentage of educators

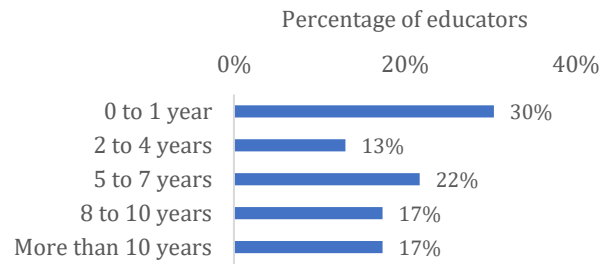| Category	Value
0 to 1 year	30%
2 to 4 years	13%
5 to 7 years	22%
8 to 10 years	17%
More than 10 years	17%

Figure 12. Educators' experience using the *SciGirls Seven* and/or the draft *SciGirls Strategies* (n=23)

Percentage of educators

Category	Value
0 to 1 year	39%
2 to 4 years	22%
5 to 8 years	39%
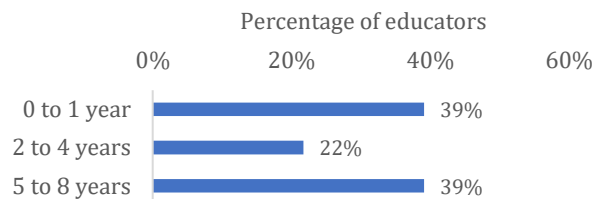
Figure 13. Impacts educators hoped their programs would have on girls (N=25)

Percentage of educators

Category	Value
Expose/encourage girls to consider STEM careers	60%
Increase awareness/knowledge of STEM and its applications	40%
Increase STEM interest/excitement	36%
Increase STEM confidence	16%
Increase problem-solving skills and comfort	16%
Build collaboration skills	12%
Other	16%
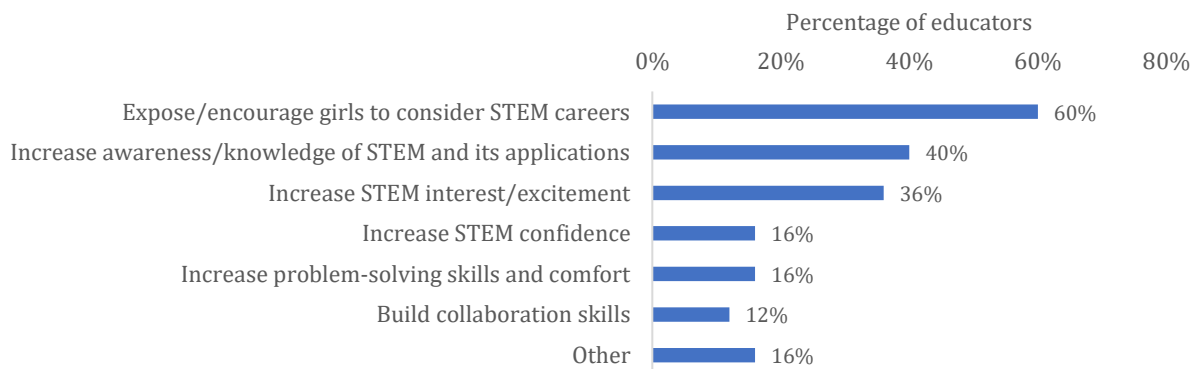
Extent to which educators thought their desired impacts were realized

Figure 14 shows the extent to which educators thought their desired program impacts were realized. The majority of the educators, three-fifths of the group, thought the impacts were realized to *a considerable extent*. One-quarter thought they were realized to *some extent*, and less than one-fifth thought they were realized to *a great extent*.[3] None of the educators thought their desired impacts were realized to *a little extent* or *to no extent*.

Figure 14. Extent to which educators thought their desired impacts were realized (N=25)
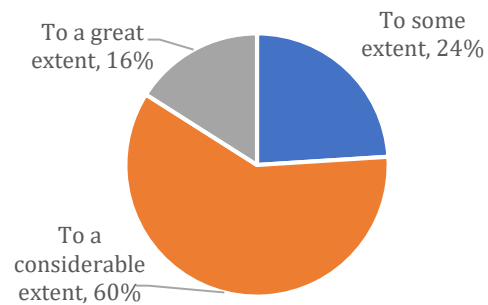
Program aspects educators thought played a role in facilitating impacts

Figure 15 shows the program aspects educators thought played the greatest role in facilitating their desired impacts among girls. Most of the educators, nearly three-quarters of the group, pointed to their use of activities or projects, and about half pointed to the in-person STEM professionals. Less than a tenth cited the *SciGirls* videos, while individual educators pointed to other aspects, including "*the field trip*," "*the consistent meeting time*," and "*the way we grouped the girls and the strategies the teachers used*."

Figure 15. Program aspects educators thought played the greatest role in facilitating impacts among girls (N=25)
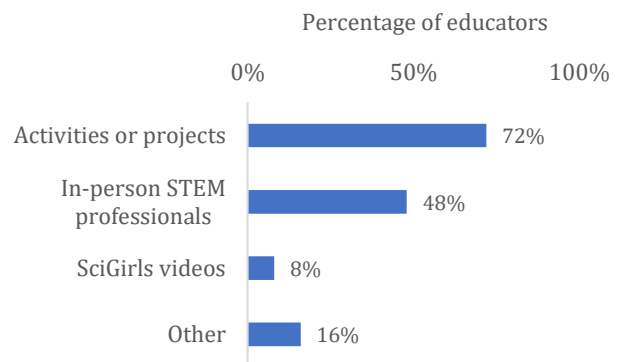
Most important SciGirls resources for facilitating impacts

Figure 16 shows the *SciGirls* resources educators felt were most important for facilitating their desired impacts among girls. Most of the educators, nearly three-quarters of the group, pointed to the *SciGirls* activities. More than two-fifths cited the episodes or episode clips while one-third each pointed to the women in STEM videos and/or the CONNECT website. Smaller groups pointed to the PBS Kids website or other resources, specifically the *SciGirls Code* curriculum and "*community mentors*," as being most important in helping achieve youth impacts.

Figure 16. Most important *SciGirls* resources for facilitating impacts among girls (N=25)

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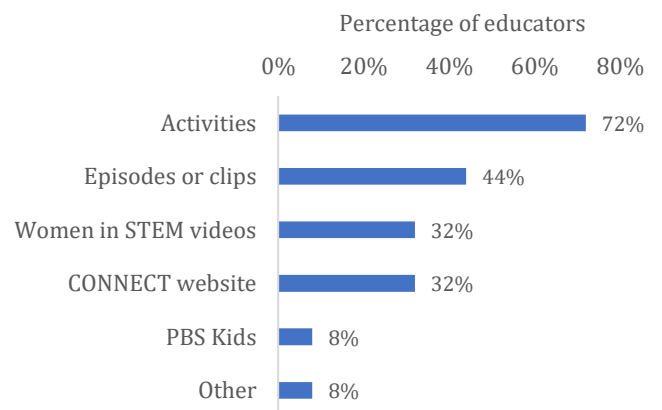
[3] When asked to explain how they assessed these impacts, nearly all of the educators described using qualitative observation or interaction (96%). Smaller groups said they used the program surveys (32%) and/or the videos made by youth (20%).

Fulfillment of Year 2 *SciGirls CONNECT²* requirements

Table 3 details if and how the individual partner organizations met the Year 2 *SciGirls CONNECT²* program requirements. As this table shows, six of the 13 partners met all of the program requirements. Those that did not quite meet one or more of the requirements are highlighted in grey shading. Partners 7-9 did not meet one of the requirements. Partners 10 and 11 each did not meet two requirements, and Partners 12 and 13 each did not meet three of the program requirements.

Table 3. Fulfillment of Year 2 *SciGirls CONNECT²* requirements (N=13)						
	Hours of *SciGirls* programming	Number of girls ages 8-13	Used in-person STEM professionals	Held family event	Created short videos	Used draft updated *SciGirls Strategies*
Partner 1	32	16	Yes (3)	Yes	Yes	Yes
Partner 2	35	20	Yes (10)	Yes	Yes	Yes
Partner 3	17	23	Yes (17)	Yes	Yes	Yes
Partner 4	35	16	Yes (5)	Yes	Yes	Yes
Partner 5	50	10	Yes (7)	Yes	Yes	Yes
Partner 6	43.5	11	Yes (3)	Yes	Yes	Yes
Partner 7	24	10	Yes (2)	Yes	Yes	Yes
Partner 8	26	8	Yes (24)	Yes	Yes	Yes
Partner 9	30	12	Yes (3)	Yes	No	Yes
Partner 10	15	18	Yes (1)	No	Yes	Yes
Partner 11	35	9	Yes (3)	No	Yes	Yes
Partner 12	24	8	Yes (2)	Yes	No	Yes
Partner 13	7	12	Yes (3)	No	No	Yes

As Table 3 shows, all of the programs implemented the draft *SciGirls Strategies*. Looking at the other elements outlined on the [project website](#), the evaluation found the following:

‣ **Offer a 16-32 hour *SciGirls* program.** Two of the 13 partners held a program shorter than the required 16 total hours (while five programs were longer than 32 hours).

‣ **Include least 10 girls ages eight to 13:** Three programs had fewer than 10 girls ages eight to 13, while the remaining programs had at least 10 girls of this age.

‣ **Include at least three female role models/STEM professionals.** Ten (10) programs included three or more in-person STEM professionals, while three did not quite meet this requirement. The evaluation did not ask partners to specify the gender of the in-person STEM professionals included in their programs.

‣ **Hold one culminating event for girls and families each year to engage families and girls in hands-on activities, sharing of learning, media viewing, and meeting female role models/STEM professionals.** Although the evaluation did not specifically ask if each component was in the culminating event, 10 programs held at least one family event during the program period (April-December 2018). Additionally, two partners indicated that their programs would continue in the spring of 2019 and said they planned to hold a

family event then, after the *SciGirls CONNECT²* program period. The remaining partner thought their culminating activity did not incorporate families to the extent intended by the project and that, as a result, they had not met this requirement.
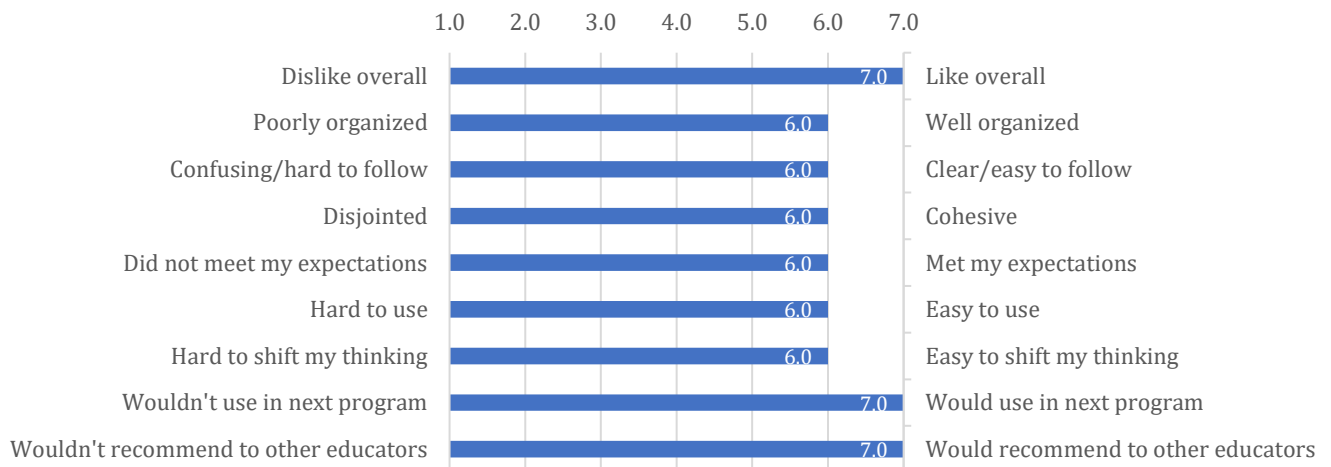
▸ **Include the creation of short videos created by girls in pairs or groups, about their STEM experiences.** Ten (10) programs included short video creation. One site said they forgot to have their youth create videos, another planned to incorporate video creation in the spring of 2019 (after the end *SciGirls CONNECT²*), and the last did not elaborate.

Findings

Part 1. Educators' response to the *SciGirls Strategies* as a whole

Figure 17 shows the educators' response to the draft *SciGirls 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 liked the strategies and thought they met their expectations. They also found the strategies to be well organized, cohesive, clear/easy to follow, and easy to use, and they further reflected that it had been easy to shift their thinking from the mindset of the original *SciGirls Seven*. Looking forward, they anticipated they would use the strategies in their next informal STEM program for girls and thought they would recommend the strategies to other educators.

Figure 17. Educators' median ratings of the draft *SciGirls Strategies* as a whole (N=25)

Left label	Rating	Right label
Dislike overall	7.0	Like overall
Poorly organized	6.0	Well organized
Confusing/hard to follow	6.0	Clear/easy to follow
Disjointed	6.0	Cohesive
Did not meet my expectations	6.0	Met my expectations
Hard to use	6.0	Easy to use
Hard to shift my thinking	6.0	Easy to shift my thinking
Wouldn't use in next program	7.0	Would use in next program
Wouldn't recommend to other educators	7.0	Would recommend to other educators

Those who shared a rating of 4.0 or lower in any area were invited to elaborate. In response, five educators commented on an aspect of shifting their thinking from the mindset of the original *SciGirls Seven*, and four commented on challenges they had faced incorporating Strategy #6: Interact with and learn from diverse STEM role models. These responses are shared on the following page.

Shifting thinking from the SciGirls Seven

- *I thought that the biggest challenge for me was getting my head out of the [old] strategies and into the new ones. The old strategies were short and concise and easy to remember for me, but the new ones are multi-faceted in a way which makes them harder to remember and more confusing for me to use and think about all the time, I have to keep referencing the sheet, BUT I do like the new strategies and I think that they're important, but they're harder for me to remember.*
- *It was difficult for me sometimes to shift my thinking to the updated strategies, I think because I was so familiar with the original strategies.*
- *I do not think that it was difficult to shift my thinking [because] the values of the SciGirls Strategies overlapped with what we want for youth [in our organization … the part that was more difficult] was me trying to remember to differentiate between the two values and principles.*
- *I felt there was little difference in the end between the SciGirls Seven and the new [strategies]. It was really only a slightly different way of looking at the practices, which is a good thing because it can help keep one focused and conscious of application.*
- *I am new to the SciGirls methodology and have no previous experience with the SciGirls Seven.*

Challenges faced incorporating Strategy #6

- *I also find it difficult to use role models on an everyday basis in my program because usually I'm the guest coming in to visit groups and I can't just bring someone with me, but I would be considered more of the role model in that scenario.*
- *Role models are really useful and helpful, but sometimes it's not always possible to invite a guest. And sometimes those guests are [not] as inclusive and great for the girls as you would like.*
- *[It's hard to find role models from diverse STEM fields who are] also diverse themselves. We would like to put as many people from our local community in front of the girls, so that it makes it even more obtainable, [if they're from communities or went to schools nearby that the girls are familiar with].*
- *Finding female stem role models might be a challenge to help girls find their inner STEM identity … [In our area], it's kind of tough to find [role models] that are in diverse STEM fields, not just the same ones, like we had three people from the same field. It's a little harder to find them and have them make time to come here.*

Part 2. Feedback on the framework
for strategy development

Part 2 considers educators' feedback on the framework for strategy development, after having incorporated it in their programs. The educators first learned about the framework during the March 2018 webinar when they were introduced to the draft updated strategies. Image 3 shows a slide from the webinar that outlines the main characteristics of the framework, as they were presented to the educators.
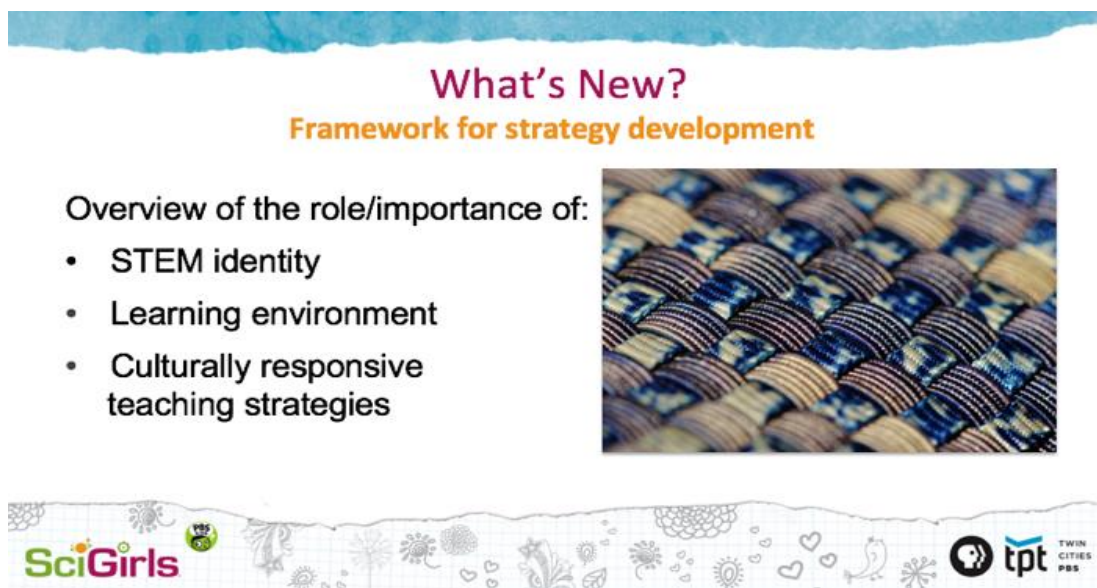

Image 3: Slide from the March 2018 webinar
presenting the draft *SciGirls Strategies*

As further detailed in the *SciGirls Strategies and Tips* document that accompanied the webinar (see Appendix 1):
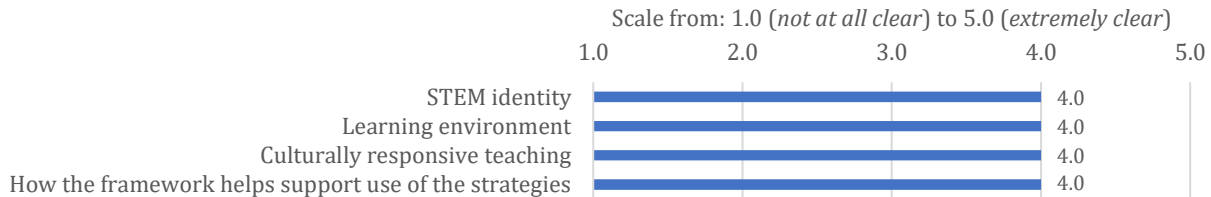
> *In addition to the SciGirls Strategies themselves, research and practice highlight the need for educators to consider the learning environment in which the SciGirls Strategies are situated and to utilize culturally responsive teaching practices to engage and effectively serve all girls in STEM, especially 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.*

The findings in this section relate to the educators' perceptions of the clarity of the framework, how easy or difficult they found it to implement, and questions or comments they shared about their use of the framework.

2.1 Perceived clarity of the framework

Figure 18 shows how well educators thought they understood four aspects of the framework at the end of their programs, using a scale from 1.0 (*not at all clear*) to 5.0 (*extremely clear*). In each case, educators generally thought they found each aspect of the framework *very clear*.

Figure 18. Median ratings of how clear educators thought they found aspects of the framework (N=25)

Scale from: 1.0 (*not at all clear*) to 5.0 (*extremely clear*)

STEM identity	4.0
Learning environment	4.0
Culturally responsive teaching	4.0
How the framework helps support use of the strategies	4.0

Those who shared a rating of 3.0 or lower were invited to elaborate. One educator (who explained elsewhere in her survey that she had not seen the March 2018 webinar about the draft updated strategies and had not reviewed the *SciGirls Strategies and Tips* document) said she did not fully understand how the framework supported use of the strategies. Another said she would like to see more examples of how to incorporate culturally responsive teaching strategies, and a third suggested providing additional information and examples but did not point to a particular aspect of the framework. These responses are shared below.

- *Not having been part of the previous conversations, I am having a hard time understanding how the framework contextualizes the strategies. This is more of a reflection on my learning curve than the framework itself.*
- *I understand the purpose and general idea of culturally responsive teaching strategies, but I would have liked to see more concrete examples of how to incorporate this into the classroom.*
- *I feel like this area could have more details and examples of strategies to implement them.*

2.2 Ease or difficulty of using the framework

Figure 19 shows how easy or difficult educators thought it was to use the three different aspects of the framework, on a scale from 1.0 (*very difficult*) to 7.0 (*very easy*). In each case, educators generally thought it was *moderately easy* for them to focus on STEM identity, consider the learning environment, and utilize culturally responsive teaching strategies throughout their use of the draft updated strategies.

Figure 19. Educators' median ratings of the ease or difficulty of using aspects of the framework (N=25)

Scale from: 1.0 (*very difficult*) to 7.0 (*very easy*)

Focus on STEM identity	6.0
Consider the learning environment	6.0
Utilize culturally responsive teaching strategies	6.0

Those who shared a rating of 5.0 or lower were invited to elaborate. Educators' comments about the challenges of using each aspect of the framework are in Table 4 on the next page.

Table 4. Educators' comments about the challenges of using aspects of the framework (N=25)

Focus on STEM identity
- *Though we got to know the girls all pretty well, I think for next time it would be useful to review the pre-surveys a little more in depth to really understand where the girls are starting in their STEM identity. Or maybe even facilitating a discussion about STEM identity as a group and what that means.*
- *Focusing on the STEM identity was difficult at times because I did not give myself enough time to cultivate it with the kids besides asking, "Oh did you like that activity?" "What do you know now that you did not know before?" [or] "What did you like about today?" While a few girls already have the idea of wanting to be an engineer when they get older, I did not get a chance [to] develop it more with others who find the activities fun but not motivating them towards an interest in STEM.*

Consider the learning environment
- *Meeting the girls on Saturday and starting the program on Monday did not allow a lot of time for us to create a personalized learning environment, so we had them all bring in two items that were special to them to try and at least personalize some of the areas. Also, good to note that sharing an education space with other programs can make this more of a challenge.*
- *It is hard to customize the learning environment to the whole group. Techniques on how to do so for a diverse group would be helpful.*
- *Our camps took place in a classroom at [a university], which was sometimes difficult to make very inviting for the girls.*

Utilize culturally responsive teaching strategies
- *While we value diversity in our approach, I don't think we were able to be responsive to the minorities' cultures (Latin American and Indian were two of the bigger minority groups). One way that we were easily able to bring diversity was through a very diverse role model panel group.*
- *I felt that I didn't have a lot of time to learn about the girls in order to make the content more relevant to them and their situation, and many of them came from similar backgrounds and [a] similar background to myself.*
- *I think more information and details on the culturally responsive teacher strategies would have been helpful.*
- *I understand the concept of culturally responsive teaching strategies. I reflect on my culture and how it might be different from the culture of my students. Other than making sure I'm not making assumptions about my students, I need more practical examples of how to be culturally [responsive].*

2.3 Questions or comments about the framework

When asked if they had questions or comments about the framework (including how it relates to the updated strategies and/or how it helps support their use of the strategies), six educators indicated they had no questions at this time or shared general comments like "*The framework provides tips which are useful in utilizing the strategies provided.*" Three educators shared a response about culturally responsive teaching, considering the learning environment, and/or flexibility in the framework. Their comments are below.
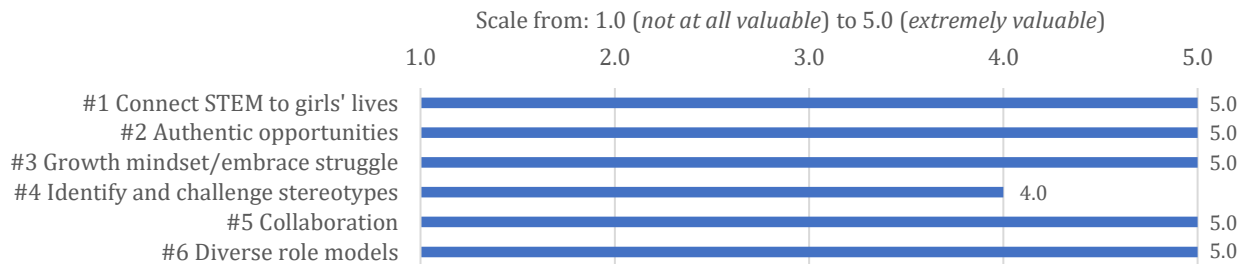
- *I think the framework is helpful and needed but I'm going to be honest and say there wasn't a ton of information for applying the framework. For example, in my program both the teachers are White but all of the students are POC and I don't think the framework gave any training on racial biases or power imbalances or anything like that. Intersectionality was key for our program (I'm not sure of the demographics of other sites) and I feel like that should have been more explicit.*
- *Because we work in mixed cultural groups, we cannot always be very specifically culturally oriented. However, an atmosphere of respect for all backgrounds is essential to move forward for a positive learning environment. Attendance varied so we had some incidents of disrespect with less frequent attendees, but the core group maintained a respectful and conducive environment for learning … [Also,] it is important to have an image of a framework, but I feel that it is equally important to maintain flexibility to maximize successful outcome.*
- *We did have the girls bring in two special items that represent them or are meaningful to them, but next time I'd like to include a portion of time for the girls to explain to the group why they brought the items they chose. Though the girls made an area to film their Flipgrid videos using their special items and all the girls were able to view the items, I think allowing time to discuss the girls' interests as a group would have brought greater understanding of their background to us and their peers.*

Part 3. Feedback on the individual *SciGirls Strategies*

3.1 Perceived value of the individual *SciGirls Strategies*

Figure 20 shows how valuable educators found the draft *SciGirls Strategies* in their programs, using a scale from 1.0 (*not at all valuable*) to 5.0 (*extremely valuable*). In general, they found each strategy *very* or *extremely valuable*.

**Figure 20. Educators' median ratings of perceived value
of the draft *SciGirls Strategies* (N=25)**

Scale from: 1.0 (*not at all valuable*) to 5.0 (*extremely valuable*)

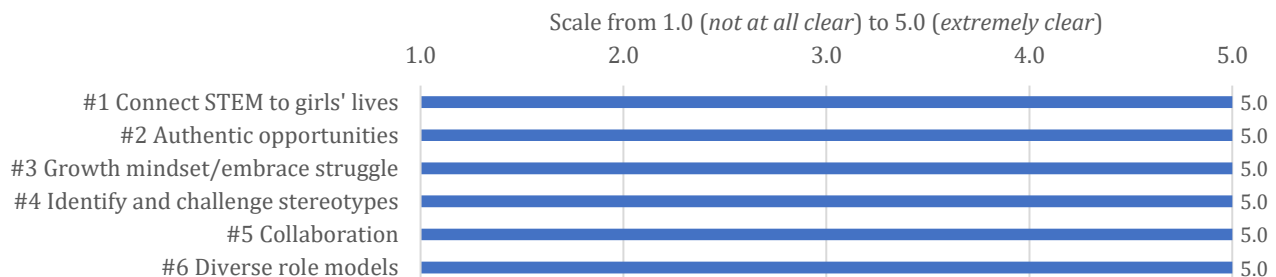|	
#1 Connect STEM to girls' lives	5.0
#2 Authentic opportunities	5.0
#3 Growth mindset/embrace struggle	5.0
#4 Identify and challenge stereotypes	4.0
#5 Collaboration	5.0
#6 Diverse role models	5.0

Those who shared a rating of 3.0 or lower were invited to elaborate. In response, one educator commented on Strategy #6 ("*We needed to provide more opportunities for role model interaction*") and three shared challenges faced (or suggestions regarding) Strategy #4, as in:

- *Difficult because the girls are so young, they are not aware of stereotypes in STEM fields really. It is hard to talk about such a heavy and divided topic.*
- *Our girls tended to be quite young so much of what they were learning was new for them and they're just working on creating a STEM identity.*
- *I think it's important to identify STEM stereotypes, but some girls may be striving to achieve those stereotypes. I think a better way to word this strategy would be: Encourage girls to bring their true selves to their STEM identity and learning space regardless of any existing stereotypes. So in other words, they can identify and acknowledge stereotypes if desired, but starting with a blank canvas and knowing that they are capable of whatever they choose in whatever capacity that career allows them is a better message than trying to contradict stereotypes.*

3.2 Perceived clarity of the individual *SciGirls Strategies*

Figure 21 shows how clear the educators found the draft *SciGirls Strategies* on a scale from 1.0 (*not at all clear*) to 5.0 (*extremely clear*). They generally found each strategy *extremely clear*.

**Figure 21. Educators' median ratings of perceived clarity
of the draft *SciGirls Strategies* (N=25)**

Scale from 1.0 (*not at all clear*) to 5.0 (*extremely clear*)

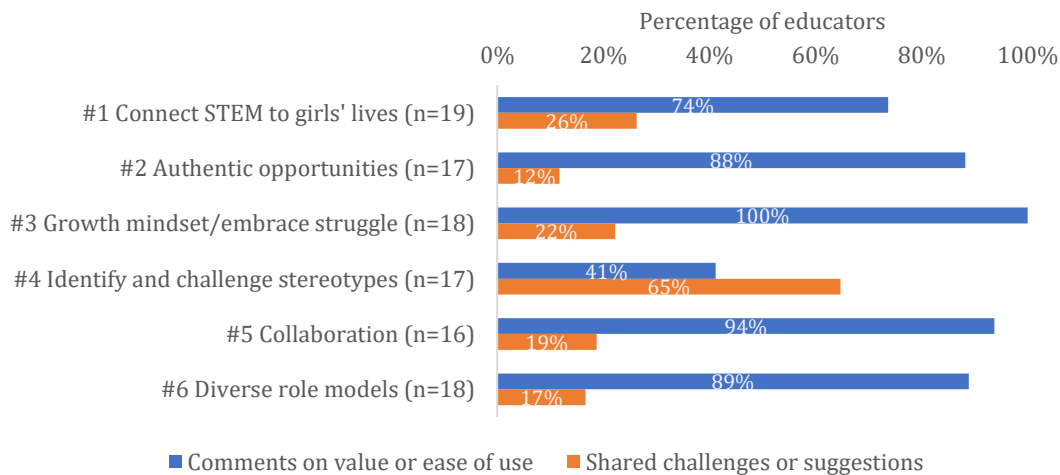|	
#1 Connect STEM to girls' lives	5.0
#2 Authentic opportunities	5.0
#3 Growth mindset/embrace struggle	5.0
#4 Identify and challenge stereotypes	5.0
#5 Collaboration	5.0
#6 Diverse role models	5.0

Those who shared a rating of 3.0 or lower were invited to elaborate. Four educators commented on aspects of Strategy #4 that they found unclear or difficult to implement, as in:

- *I feel like #4 is trickiest to understand HOW to actually do that. Most of the strategies are clear in how to implement them, but I felt that #4 is trickier.*
- *The only slightly unclear thing in the strategies [is] the use of "true selves." I'm not 100% sure what that means. True selves in the sense of their identity or personality or both?*
- *More ideas on how to bring their true selves into the learning space would be helpful.*
- *Providing opportunities for these girls is easy, and having conversations about STEM is easy. Encouraging girls to identify and challenge stereotypes is the hard part. Especially with girls that are 10-years-old. In a rural area [they] are not used to a lot of culture or gender diversity.*

3.3 Educators' 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 was immediately actionable. Figure 22 shows the percentages of educators who remarked on the value or ease of use of each strategy, as well as the percentages who commented on challenges they encountered and/or gave suggestions for how TPT might revise or support their use of each strategy.

Figure 22. Educators who shared comments about each of the draft *SciGirls Strategies*

Percentage of educators

Strategy	Comments on value or ease of use	Shared challenges or suggestions
#1 Connect STEM to girls' lives (n=19)	74%	26%
#2 Authentic opportunities (n=17)	88%	12%
#3 Growth mindset/embrace struggle (n=18)	100%	22%
#4 Identify and challenge stereotypes (n=17)	41%	65%
#5 Collaboration (n=16)	94%	19%
#6 Diverse role models (n=18)	89%	17%

■ Comments on value or ease of use   ■ Shared challenges or suggestions

Among those who shared a response in each case, three-quarters or more of the educators commented on the value or ease of use of Strategy #1, Strategy #2, Strategy #3, Strategy #5, and Strategy #6, while two-fifths commented on the value or ease of use of Strategy #4. At the same time, two-thirds of those who shared a response commented on challenges they encountered using Strategy #4 and/or gave suggestions for how TPT might revise or support their use of this strategy. Meanwhile, smaller groups of those who shared a response (one-tenth to one-quarter each) shared concerns about the other five strategies, again commenting on challenges faced or offering suggestions for how TPT might revise or support their use of each strategy.

Examples of the educators' comments are presented in Table 5, on the following two pages.

Table 5. Educators' comments about the draft *SciGirls Strategies*

#1 Connect STEM to girls' lives (n=19)

Commented on value or ease of use (74%)
- *This strategy was easily implemented by virtue of the way SciGirls is designed. The episodes and the activities were derived from the perspective of young girls in real life experiences. This makes it adaptable to all communities.*
- *Easily actionable through facilitating the discussion with the activities; clearly described*
- *I feel like this strategy is really clear to understand and that it's easy to implement and that by relating STEM experiences to girls' lives, we are being culturally sensitive and it's more meaningful to them*
- *This was one of the most beneficial and easy to implement strategies for our group of girls*

Shared challenges or suggestions (26%)
- *I definitely think this is a super important strategy, but sometimes it's a challenge to connect STEM experiences to girls' lives. Gaining more knowledge about girls' interests and past STEM experiences would be helpful to incorporate their strategy better.*
- *We found that this strategy was a little difficult in that we only had a week with the girls so there wasn't a lot of time to get to know the girls' lives individually and we had to make assumptions on girls' lives because of this situational circumstance.*
- *Coming up with a list of questions that would guide this strategy would be helpful.*
- *Fairly easy to understand. This feels like a great focus for the initial part of a longer program as it can be incorporated into the team development activities like ice-breakers, etc.*

#2 Authentic opportunities (n=17)

Commented on value or ease of use (88%)
- *We tried to give our girls very real-world experiences that encouraged them to experiment and explore and fail in a safe environment. I think this strategy is clear and helpful.*
- *Easily actionable through facilitating the activities; activities lend themselves to the open-endedness needed for this strategy; clearly described*
- *This is very easy to meet by just facilitating any of the SciGirls activities.*
- *It was easy to relate STEM in the lives of the girls in a manner that they could relate to, explore and to drive even greater knowledge. Subjects were relatable.*

Shared challenges or suggestions (12%)
- *I think something about "hands-on STEM" needs to be in this descriptor, like: Provide authentic opportunities through "hands-on STEM" that mirror the practices of STEM and help girls develop their own ways of exploring and sharing knowledge.*
- *This is slightly more difficult for a younger age range who have more limited knowledge and skills to explore applicable STEM material.*

#3 Growth mindset/embrace struggle (n=18)

Commented on value or ease of use (100%)
- *Several science investigations required the girls to re-do [them] the next day. This practice allowed them to understand the practice of making mistakes and learning from the process in order to discover new results. The girls created a culture of learning through inquiry and investigation.*
- *I think that this is particularly important and relevant to STEM for women, especially young women. Feeling comfortable with the process that incorporates "failure" can lead to more comfort and confidence.*
- *This is something that I think many youth struggle with and I saw it in our girls during the week that they felt like they had failed if they did something wrong, and we tried to make it abundantly clear that failing was okay*
- *I think it is so important to have this strategy. It is important to find good activities to allow students to struggle and succeed.*
- *This was big! They figured out how to work through problems by collaborating with each other.*
- *Many of the girls that participated never thought of themselves as scientist[s]. It was great to see that the programming increased self-confidence.*

Shared challenges or suggestions (22%)
- *Clear but challenging.*
- *Strategy is great but not sure all educators apply it. I would like to see lots of good examples provided for educators to use with their girls.*
- *I feel like providing some short growth mindset types of activities OR provide sample comments or statements for the teacher to use to build this would be helpful.*
- *The ages that SciGirls targets are tender ones, and it takes real tact and skill to help girls improve their confidence in their STEM identity and to teach them that failure is not always a bad thing. I've found this strategy to be difficult to employ in group settings [in the past].*

#4 Identify and challenge stereotypes (n=17)

Commented on value or ease of use (41%)
- *The role models brought this strategy into the conversation; clearly described*
- *By the end of the program, many of the girls thought of different careers for minority women.*
- *We wanted the girls to see themselves as scientists and I do think throughout the week they were able to grow into those roles more with some of the activities as they got more confident in their new skill sets with coding*
- *Girls were made to feel comfortable with themselves and not accept the stereotypical labels associated with STEM. Instead, girls had a greater sense of confidence in the learning space mainly because of the unique design of the program.*

Shared challenges or suggestions (65%)
- *I don't think it's entirely necessary to challenge STEM stereotypes as this may be what the [girl] is striving for. I think what's more important is for girls to be authentic and confident in their "true selves" as being capable of whatever they work towards.*
- *Feel like this strategy is the most difficult to put into action. It could be due to the specific audience and age group we dealt with.*
- *I feel that this is hard for them to act on and is, therefore, a more facilitator-centric strategy that should guide the preparation of the educator team.*
- *Something about how it is worded with stereotypes I don't think is "friendly" in this strategy. I think the bring your true self is important. I am not sure how to reword it but I don't want to bring up an issue that the girls are not aware of already.*
- *There might be some questions on what the girls' true selves and learning space are. How do we encourage them to bring their true selves into this space and how does the educator make a truly safe space for them?*
- *I'm unclear about the use of true selves here. Does that mean identity, personality, possibly both? I think it's meant to mean both but it's a very general term.*
- *We might need more concrete examples of ways to do this properly.*

#5 Collaboration (n=16)

Commented on value or ease of use (94%)
- *Activities lend themselves to this - we rotated groups to keep them engaged and allow for different personality types to engage in different ways; clearly described*
- *The activities create a ... collaborative atmosphere for STEM learning.*
- *Yes, they collaborated in the activities, but it was also apparent when they presented and were jumping in and adding on to explain their learning.*
- *I think the consistent meeting times and space provides this opportunity and the girls love it*
- *The program was very social in nature; there was plenty of opportunity for them to be casual, comfortable and in most cases, non-threatened with a "grade" as the outcome.*
- *This was also one of our most successful strategies ... we had a fairly small group who could get to know each other fairly quickly*

Shared challenges or suggestions (19%)
- *Though much of STEM is collaborative, there are many aspects of STEM that are not, and I feel it's important to show the girls all options not just the "sexy" science ones. I do agree that generally in whatever field or career one chooses there is value in being able to work together cooperatively as a team but also letting SciGirls know that sometimes you work alone in a lab is ok too.*
- *Adding a male into the room really changes the dynamic especially for girls at a young age. It is really interesting to see this in effect and really important to recognize.*

#6 Diverse role models (n=18)

Commented on value or ease of use (89%)
- *Love this one and always have! Introducing girls to female role models at all stages of their careers is vital to encouraging them to feel ok with trying and succeeding and/or trying and failing. It's all valuable experience! And also, it's amazing for SciGirls to see someone that looks like them or someone from the same background pursuing a career in which they are also interested.*
- *The role models were women reflective of their racial background who could easily relate to their experiences. They developed a level of comfort in discuss[ing] the fields of STEM shared.*
- *I felt like this was important. It's very clear, it's very simple, and I feel like they got a lot out of it.*
- *This is the strategy that I think is most important in appealing to a diverse set of girls. Seeing other women like them succeeding and working in a STEM environment is important.*
- *The role models were the best part of the programs, I think hearing from women in science careers truly changed the way the girls saw themselves.*
- *Learning from others who have achieved careers in STEM is important because it fosters curiosity and excitement.*
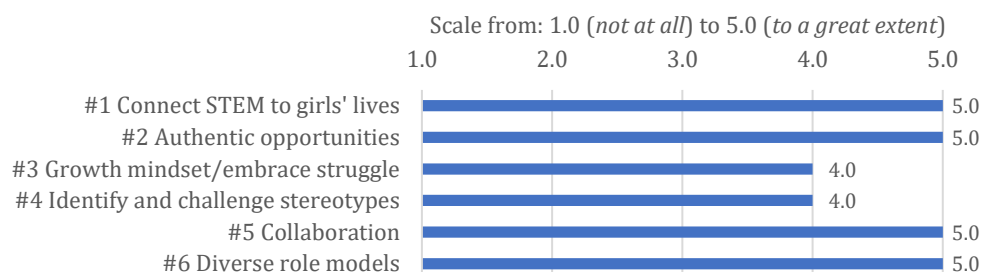
Shared challenges or suggestions (17%)
- *This was the hardest to achieve in our 5-day camp as [ours] isn't the most diverse city and we didn't have a lot of guests, but we did utilize online SciGirls resources.*
- *We could have done better here. The two role models were white women.*
- *... please continue to provide role model videos that can be incorporated into programming.*

Part 4. Use and perceived goals of the *SciGirls Strategies*

4.1 Frequency with which educators used the *SciGirls Strategies*

Figure 23 shows the extent to which educators thought they had used each of the draft *SciGirls Strategies* on a scale from 1.0 (*not at all*) to 5.0 (*to a great extent*). Overall, they generally indicated that they had used each strategy to *a considerable extent* or *a great extent*.

Figure 23. Educators' median ratings of the extent to which they used each draft *SciGirls Strategy* (n=24)

Scale from: 1.0 (*not at all*) to 5.0 (*to a great extent*)

Strategy	Rating
#1 Connect STEM to girls' lives	5.0
#2 Authentic opportunities	5.0
#3 Growth mindset/embrace struggle	4.0
#4 Identify and challenge stereotypes	4.0
#5 Collaboration	5.0
#6 Diverse role models	5.0

When asked to reflect on their ratings and comment on aspects of the individual strategies that they thought might have facilitated their using them to a greater or lesser extent, just over half of the educators commented on the strategies they had used to *a great extent*, with the majority in this group pointing to Strategy #6, perhaps highlighting an enthusiasm for incorporating diverse STEM professionals into their programs. Meanwhile, three-fifths commented on the strategies they had used to *a considerable extent* or less, with the majority in this group pointing to Strategy #4, potentially indicating that some educators found the strategy somewhat more difficult to incorporate. Examples of their responses in each case are in Table 6, below and on the following page.

Table 6. Educators' comments about the frequency with which they used the draft *SciGirls Strategies* (n=24)	
Strategies used to a great extent (54%)	***Strategies used to a considerable extent or less (58%)***
#3 Growth mindset/embrace struggle (3) • *Again I'm going to go back to the growth mindset, it was the one I had infused in every session, only because I have had success with it in the past, so I used it again with SciGirls ... to me, it's the most powerful strategy.* • *After doing this for a few years we really noticed the impact of [what are now strategies #3, #5, and #6] ... I think we've had the most impact highlighting those three, using the SciGirls Seven and how they're updated now.* *#5 Collaboration (6)* • *For the collaboration piece, I think it works well with the growth mindset strategy ... seeing that they are valued as individuals, and [seeing] where they're at, and collaborating with each other, it created a really positive environment for them.*	*#1 Connect STEM to girls' lives (2)* • *I feel like we almost delivered a vignette of STEM, versus a narrative of STEM that connected them to their past experiences, and their future, and their current [selves] ... [Not having experience in an area could be marginalizing], but creating an easy way for them to have a connection to one of their experiences [in an earlier program activity] may enhance their experience and their willingness to go further in that activity.* • *For me, culturally responsive teaching is something that I have not had a lot of training on and still have a lot of questions about ... I don't want to do it wrong ... [and with our program being short], we know the girls to some extent [but there's a lot we don't know about them], so I don't know what [Strategy #1] would look like in the form of our program. I would have prioritized this one [if we ran a longer program].* *#2 Authentic opportunities (5)* • *[As for Strategy #2 being used to some extent] ... we only have certain hours a day and we want to get so much curriculum, so we often provide the ways that they will share their knowledge and do their own investigations, and I don't know what that would look like to just leave*

- *With the fifth strategy, I think that's just part of what we do, having students work together. There's a lot of group work that they do, and then building on when they were working on their own project, building in opportunities for them to share with each other or ask questions to each other, I'd encourage that. I think I said we used [that strategy to a great extent] because we did it every time.*
- *[We also used the collaboration strategy a lot] because, with the STEM activities or experiences, there's always something to troubleshoot or a problem that [is] within it ... so they have to work together to solve the problem, so that's [another strategy] I always went back to.*

#6 Diverse role models (9)
- *The girls really enjoyed have visits from the mentors. We had [three mentors visit or video chat with the girls] and the girls were wonderful, they asked such wonderful questions that were pointed toward their actual career path ... some of them said "Well, I want to be a lawyer, but I can see how studying science could help me be a better lawyer." They really were able to draw the things they were learning from the different scientists ... so I really thought it was powerful, the girls enjoyed it, you should have seen them, they had notebooks and they were taking notes and listening to what the different guests were telling them. It was really great to see them enjoy that experience.*
- *With the role models, we strive really hard to have role models each day, engaging with students and bringing activities, and we showed videos from SciGirls about other female role models, so I guess in general we use that strategy quite a lot, and we have a lot of wonderful role models ... that we always lean on or ask ... they've all said they want to engage and so they're all really active.*
- *I just thought that, having used [this strategy] before but not to the same extent in our prior programming, after the initial conversation with the scientist over Skype, when I saw the conversations that were taking place ... [it] made me want to use it more. I think the other times we've used [this strategy] we've had the school science teacher come in, [or local people, but after the Skype call with the first scientist, the girls] had such great questions and they were so intrigued. And the conversations were taking place days later. They really took it in.*
- *When our role models were there, usually every single one of the strategies was hit.*
- *I tried to invite [the girls'] parents and talk about it with their parents, and [most of them didn't work in STEM], but ... we were able to talk about people they knew in their home countries that were in STEM fields or were related to that, to help [the girls] picture and realize [the opportunities available to them.]*

- *it more open, especially for shorter-term projects [as opposed to projects they work on for a week or more]*
- *I think [Strategy #2] went hand-in-hand with [our using] #6 [less], because [we weren't able to help them] feel authentically connected to someone else, because [we had trouble scheduling role models].*

#3 Growth mindset/embrace struggle (1)
- *I also want to speak on why #2, #3, and #4 were more of a challenge for me. Getting the kids to be motivated was a huge challenge, and so it was hard ... to get them apply the same knowledge [and curiosity] beyond the program [in other aspects of their lives] ...*

#4 Identify and challenge stereotypes (10)
- *We have role models come and talk to the girls, and they'll share their experience about how they've been the only female or they had this tough situation happen to them, but I don't know if we've ever allowed our girls to challenge those stereotypes themselves.*
- *We rarely implemented/touched base on Strategy #4. I believe that the girls now, the age group that we have, I feel like they've been raised in a society where girls can do anything ... so [instead of focusing on negative stereotypes, we embraced what they already think, showing them] all these women who are doing these things. Some role models would talk about [how few girls were in their college programs, but they also talked about how much higher these numbers are now]. I don't think the girls that we work with have experienced that they can't do what the boys are doing. I feel like we've had a shift in education ... where girls are doing just as well as boys in math and science, and they participate equally, if not better, in those areas ... I don't know if that's for everything, that's just what I see in our program.*
- *I felt that I didn't use #4 as often as the others. I think part of it might have been our girls' age.*
- *They didn't know much about STEM, so they definitely didn't know about STEM stereotypes. [But we did address it, a little bit, in terms of showing them some of the many things a scientist can be.]*
- *I think that was one of the more challenging ones to use, because it's a little vague in the sense of "true selves." I think the other ones are very clear and easy to do and [easy to recognize that you've used them], whereas that one is a little less clear ...*
- *... the way it's phrased is to acknowledge and explicitly counter stereotypes about women in STEM, and we did that, we had conversations about that, but I don't know that I necessarily agree with that statement, because countering a stereotype means saying it's wrong, and there are also a lot of really positive stereotypes of women in STEM ... I know when I was a little girl, having female role models who were okay with being dorky and nerdy and seeing that they were still cool, that was a positive influence in my life ... I think there are just so many positive stereotypes out there too, I don't necessarily think countering those or shying away from them was a big focus of ours.*
- *We approached this one more to expand the girls' horizons than to specifically counter what's out there. ... so it was more like, "You might think these are the only career options that exist for this particular topic, but look at all of these other options!" ... the part of that strategy I really loved is "bring their true selves" – no matter what that is, if you want to be the stereotype or if you want to do something different, just been authentic and be confident in what you want to do and in your abilities.*

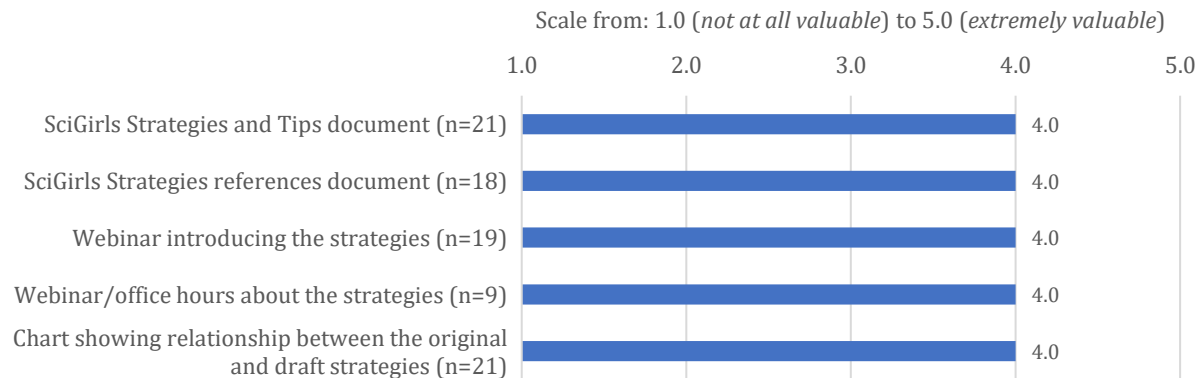### #6 Diverse role models (2)
- *I think that it wasn't as much as last year because we didn't have as many role models come in as we would have liked, or that we anticipated.*
- *We did not have as many role models as we wanted, but we will continue to work on improving this. It had nothing to do with the strategy, it's the circumstance and trying to get the role models plugged in [at] the appropriate times.*

4.2 Materials and resources that facilitated use of the *SciGirls Strategies*

Perceived value of preparatory materials provided to facilitate use of SciGirls Strategies
Figure 24 shows how valuable educators found four *SciGirls* materials intended to facilitate their use of the draft *SciGirls Strategies*, on a scale from 1.0 (*not at all valuable*) to 5.0 (*extremely valuable*). In general, those who used the materials found them *very valuable*.

Figure 24. Median educator ratings of perceived value of the preparatory materials intended to facilitate use of the draft *SciGirls Strategies*

Scale from: 1.0 (*not at all valuable*) to 5.0 (*extremely valuable*)

Material	Rating
SciGirls Strategies and Tips document (n=21)	4.0
SciGirls Strategies references document (n=18)	4.0
Webinar introducing the strategies (n=19)	4.0
Webinar/office hours about the strategies (n=9)	4.0
Chart showing relationship between the original and draft strategies (n=21)	4.0

When those who shared ratings of 3.0 or lower were invited to elaborate, a few commented on the webinar introducing the strategies, a few commented on the documents, and one commented on the chart comparing the original *SciGirls Seven* with the draft *SciGirls Strategies* (shown in Image 1 on page 7), as in:

Commented on the webinar introducing the strategies
- *The webinar was valuable but I feel could have been presented in a more organized and engaging way.*
- *I feel like the webinar just read over what the documents already told me. Specific ways of implementing it or seeing an example of what this looks like in a learning setting with girls would have been helpful.*
- *I don't like webinars and don't get a lot out of them. I prefer to read material on my own.*

Commented on the documents
- *To be honest, I read the resources and then forget about them during the course of the program. I think I have a decent understanding of the goals and strategies and then just let the program run organically without checking back on the documents.*
- *The references document doesn't go into the details needed. Good for "reference" but not something I'd look at frequently.*
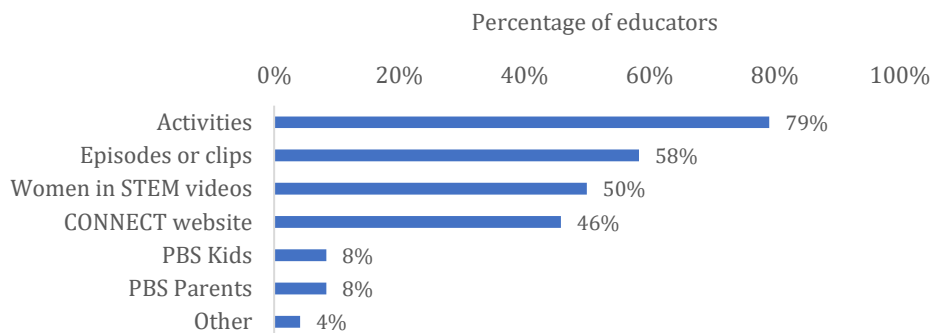
Commented on the chart
- *Chart is [good for reference but not something I'd look at frequently]. Interesting to see comparison, but more interested in the Strategies and Tips document.*

Most useful resources for implementing the SciGirls Strategies
Figure 25 on the next page shows the resources educators found most useful in implementing the draft *SciGirls Strategies*. Though not shown, three-quarters pointed to more than one resource (75%). About four-fifths pointed to the *SciGirls* activities, while nearly three-fifths pointed to the episodes or episode clips, half pointed to the women in STEM videos, and just under half to the CONNECT website. Less than a tenth each pointed to PBS Kids, the PBS Parents website, or other resources. A small group elaborated, as shared below the chart.

Figure 25. Resources educators found most helpful in implementing the draft *SciGirls Strategies* (n=24)

Percentage of educators

Activities	79%
Episodes or clips	58%
Women in STEM videos	50%
CONNECT website	46%
PBS Kids	8%
PBS Parents	8%
Other	4%

Activities
- *I feel the activities … all directly address the SciGirls Strategies and for us were the best to implement them.*
- *I feel like the activities allow for Strategies #2 and #3 to be utilized heavily*

Episodes or clips from episodes
- *We used clips from some of the episodes to link in the SciGirls connection to our activities.*
- *I feel the … episodes all directly address the SciGirls Strategies and for us were the best to implement them.*

Women in STEM videos
- *I thought that the Women in STEM videos were helpful, I found one that related to what one of the girls wants to do as a career and we were able to watch that one and relate it to her life. It was also was sort of like having another role model involved. Getting to see what people in STEM do.*

CONNECT website
- *The CONNECT website is a primary resource to access the info.*

4.3 How the *SciGirls Strategies* were considered in planning and implementation

How educators considered the SciGirls Strategies

Figure 26 shows that the educators were somewhat divided in how they considered the draft *SciGirls Strategies* in the planning and implementation of their programs. Two-fifths indicated that they had prioritized one or more strategies consistently. A third said they had used the strategies synergistically or as a set, and one-quarter said they used different strategies in different situations.[4]

Figure 26. How educators considered the draft *SciGirls Strategies* (n=24)

Used different strategies in different situations, 25%

Used the strategies synergistically/as a set, 33%

Prioritized one or more strategies consistently, 42%

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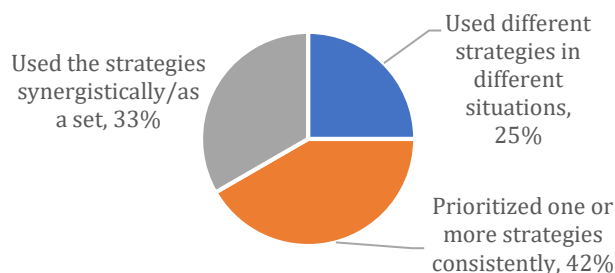
[4] Educators were asked to select one of the three options shown in Figure 26 (or to select "Other" and briefly elaborate, an option none of the educators chose). The three categories in Figure 26 were drawn from educators' responses to the Year 1 post-program evaluation survey, which asked how they considered the *SciGirls Seven* in an open-ended question. These three categories were the most common responses given.

Extent to which educators structured their planning and implementation of the SciGirls Strategies

Educators were asked to share the level of structure they brought to their consideration of the draft *SciGirls Strategies*, as follows: *How structured was your planning and implementation of the draft updated strategies? Would you say not at all structured, slightly structured, moderately structured, very structured, or extremely structured?* Figure 27 shows that approximately half of the educators thought their consideration of the strategies was *moderately structured*. About a fifth thought their consideration of the strategies was *very structured*. Smaller groups thought their approach was *slightly structured* or explained that the structure they brought to their use of the strategies changed over the course of the progam, with one describing an increase in structure as youth moved from "*light projects to project-based learning*" and the other observing a decrease in structure as their organization's educators became more comfortable with the strategies. No one thought their consideration of the strategies had been *extremely structured* or *not at all structured*.

Figure 27. How structured educators were in their planning and implementation of the draft *SciGirls Strategies* (n=21)
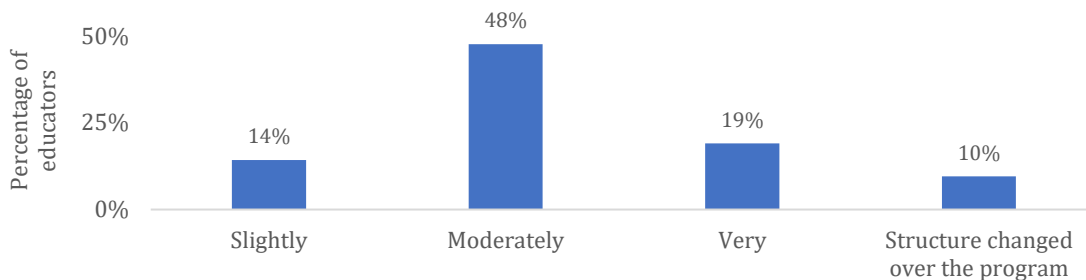
How educators' consideration of the strategies compared to prior use of the SciGirls Seven

Educators who had prior experience with the *SciGirls Seven* were asked to compare their consideration of the original and draft updated strategies. They were asked: *Was your approach of [prioritizing one or more strategies consistently, using the strategies synergistically or as a set, or using different strategies in different situations] similar to or different from how you previously used the original SciGirls Seven?* Among the 15 who shared a response, all but two thought they had considered the *SciGirls Seven* in a similar manner. One was not sure, and one explained she had used a different approach in considering the draft updated strategies, as in, "*We used to think of [the strategies] more holistically, but we've kind of moved away from that in planning our lessons … [Now we are prioritizing one or more strategies consistently because] we're trying to make it more individualized for the girls. If we can focus on one or two or three of the strategies at a time, we can hopefully go deeper with that than trying to hit all of them.*"

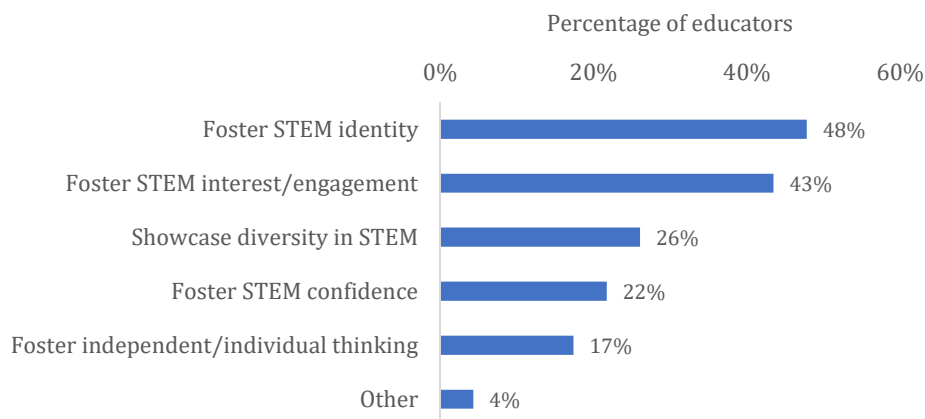## 4.4 Whether fostering girls' STEM identity was viewed as a goal of the *SciGirls Strategies*, and if educators thought this goal was met

Educators' perceptions of the overall goals of the SciGirls Strategies and whether they identified fostering girls' STEM identity

Prior to their use of the draft updated *SciGirls Strategies*, educators were informed that the goal of the framework for strategy development was to foster girls' STEM identity.[5] [6] This was also identified as the goal of the strategies as a whole in subsequent correspondence between TPT and the evaluation team, although it was somewhat less explicitly identified in the preparatory materials shared with educators prior to their use of the draft *SciGirls Strategies*. Thus, this phase of the evaluation asked educators to identity what they perceived to be the overall goal of the *SciGirls Strategies*, to determine if their responses aligned with TPT's intended goal.

Figure 28 shows what educators perceived to be the overall goal(s) of the draft *SciGirls Strategies*. Though not shown in Figure 28, approximately half of the educators cited more than one goal (48%). The largest group, half of the educators, identified the goal of fostering girls' STEM identity, either by mentioning STEM identity directly or referencing it sufficiently, as in, "*I felt like the overall goal of the strategies was to … have the girls really see how [STEM] fits into their lives and their future.*" About two-fifths pointed to the goal of fostering girls' STEM interest or engagement, and one-quarter said they thought the goal was to showcase diversity in STEM. Smaller groups of one-fifth or less commented on fostering girls' STEM confidence, fostering independent/individual thinking, or gave another response. Examples of their comments are in Table 7 on the following page.

Figure 28. Educators' perception of the overall goal(s) of the draft *SciGirls Strategies* (n=23)

Percentage of educators

Foster STEM identity	48%
Foster STEM interest/engagement	43%
Showcase diversity in STEM	26%
Foster STEM confidence	22%
Foster independent/individual thinking	17%
Other	4%

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[5] As noted in the *SciGirls Strategies and Tips* document in Appendix 1,"*the learning environment and culturally responsive teaching practices [aspects of the framework] are important in helping foster a STEM identity*."
[6] 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.*

Table 7. Perception of the overall goal(s) of the draft *SciGirls Strategies* (n=23)

Foster STEM identity (48%)
- *The goal was really to help them to develop a STEM identity for themselves …*
- *I say it was to really get the girls to figure out what they want to do in the science field. It's so broad, but for them to do different activities, it was easier for them to be able to say they liked this or they don't like this, so it's not like "Oh I hate the sciences," they just don't like a certain part of it, but they love another part, so their STEM identity was more clear this time.*
- *I felt like the goal was maybe more cohesive building that STEM identity for girls, and each of the strategies kind of contributed toward that building of STEM identity.*
- *To foster or improve the girls' STEM identity … I think the overarching theme of all of it is to create a positive feeling towards STEM, confidence in STEM, it all kind of comes back to creating that identity, knowing what it means to you and how you feel about it.*
- *To support young women in recognizing the fact that science can be female, that can be associated with women, and that the girls … could consider themselves as scientists.*
- *I think [the goal was] … to make it more real world for them and obtainable, in a way, to see themselves in a STEM field, I think came across a little clearer this time around.*
- *[Encouraging girls to explore STEM] and what it has to offer and why they would want to be involved in STEM.*
- *I felt like the overall goal of the strategies was to … have the girls really see how [STEM] fits into their lives and their future.*

Foster STEM interest/engagement (43%)
- *I think the overarching theme of all of it is to create a positive feeling towards STEM …*
- *To help the girls' interest in STEM. Teaching girls to be interested in STEM …*
- *I see the overall goal was to increase and expand interest in STEM.*
- *… really giving them an opportunity to flex that STEM muscle and figure out what they like and what they don't like.*
- *I see them as a way to communicate those best practices [for] engaging girls in hands-on STEM experiences, and STEM experiences overall … I think their purpose is also to provide an easy guide for formal and informal educators of how to do this work.*

Showcase diversity in STEM (26%)
- *When I read through it, the goal was to try to bridge that gap, especially between genders, in the STEM fields, because a lot of the time when people hear about STEM they think "Oh okay, men do that" … So for me it was a great way to see how it's all about how to embrace that idea that we need more women in the STEM fields, we need more representation, we need more ideas, more diversity.*
- *Something that really stuck out to me [in our use of the updated strategies] was implementing more diversity. So we really tried to find more diverse [role models to visit the girls, and once a week we also presented a PowerPoint about] someone who couldn't come to us in person, but [who] was known nation-wide or world-wide, from a diverse background as well.*
- *The other thing that I thought was major in what we did for this year was to break stereotypes of who is in STEM*
- *I thought that they were [focusing more on] diversity and how to do that. So it's an intentionality.*
- *I think it was … maybe looking a little deeper at culture and diversity.*

Foster STEM confidence (22%)
- *… create confidence in STEM*
- *And building a confidence in them too – I think all of [the strategies] help them to feel more confident about doing something in STEM.*
- *The strategies were more … focused on their self-confidence*

Foster independent/individual thinking (17%)
- *I thought that the overall goal [of the strategies] was to allow girls to think outside the box, and to be independent thinkers*
- *I think it was more focused on them individually as learners, so that they're able to focus on learning about STEM.*
- *… giving them their own voice.*

Other (4%)
- *I think it was a merging of some overlapped strategies …*

Whether educators who identified the goal of the SciGirls Strategies as fostering girls'
STEM identity thought this goal was met

Among the 11 educators who correctly identified the goal of the draft *SciGirls Strategies* as fostering girls' STEM identity, nine said they thought this goal was achieved in their programs.[7] Figure 29 shows the key strategies that these educators then went on to say played a primary role in their programs achieving this goal. Most commented on their use of Strategy #6, while smaller groups pointed to: their use of Strategies #1, #3, #4, and #5; how they considered the learning environment; how they presented STEM in a new or different way; and/or how they gave girls a voice.

**Figure 29. The key strategies that educators thought
helped their programs foster girls' STEM identity (n=9)**
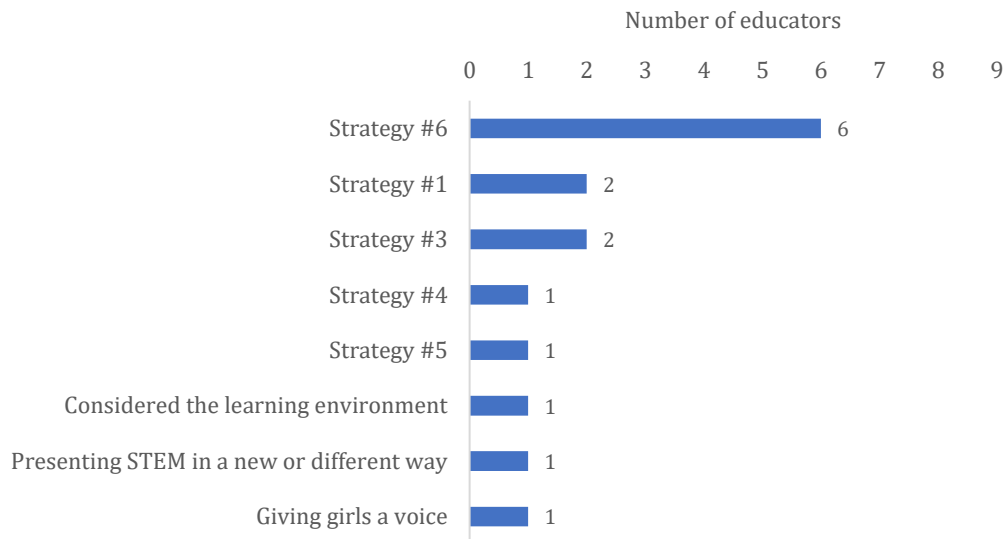
Meanwhile, two educators said they thought the goal of fostering girls' STEM identity was only partially met in their programs. When asked to elaborate, one educator said they could have done more to incorporate Strategy #6 and another felt they had not had enough time with their girls.
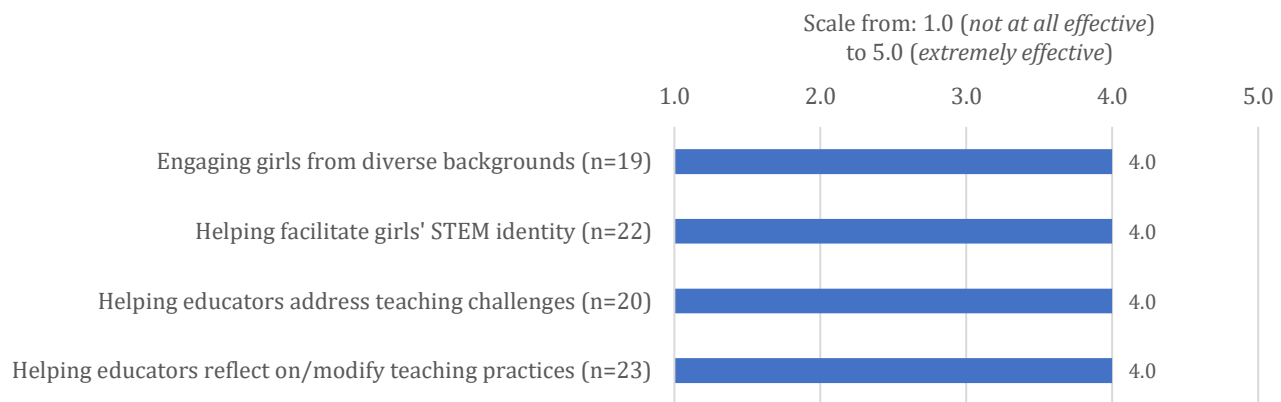
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[7] Among the 12 educators who identified <u>other</u> goals of the draft *SciGirls Strategies* (including showcasing diversity in STEM and fostering STEM interest/engagement, confidence, and independent/individual thinking), eight thought these goals were met in their programs. When asked what they did that helped in achieving said goals, four of these educators commented on their use of Strategy #6 and one each pointed to: their use of Strategy #3; how they had considered the learning environment; how they presented STEM in a new or different way; or how they used all of the strategies together. Meanwhile, one educator thought the goal s/he had identified (of showcasing diversity in STEM) was not met, and three thought the goals they had identified (of showcasing diversity in STEM and/or fostering STEM interest/engagement) were only partially met in their programs. When asked if there was anything they didn't do that might have helped in meeting these goals, two educators said they could have done more to incorporate Strategy #6 and one thought they could have done more to incorporate Strategy #1. Another felt they had not had enough time with their girls, and still one more thought their second educator would have benefitted from additional training on the draft *SciGirls Strategies.*

4.5 Whether educators who identified the goal of the *SciGirls Strategies* as fostering girls' STEM identity thought the way they considered the strategies in planning/implementation helped facilitate this goal

Among the 11 educators who correctly identified the goal of the draft *SciGirls Strategies* as fostering girls' STEM identity, a few each said they used the strategies synergistically or as a set, prioritized one or more strategies consistently, or used different strategies in different situations. Figure 30 shows that most of these 11 educators went on to explain that they thought their respective approach helped facilitate the goal of fostering girls' STEM identity. The two educators who thought the goal of fostering girls' STEM identity was only partially met in their programs both indicated that they had prioritized one or more strategies consistently. When asked if they thought this approach to the strategies contributed to any challenges faced in meeting this goal, both said no.[8]

Figure 30. If educators thought the way they considered the draft *SciGirls Strategies* helped facilitate the goal of fostering girls' STEM identity or contributed to any challenges faced in meeting this goal (n=11)

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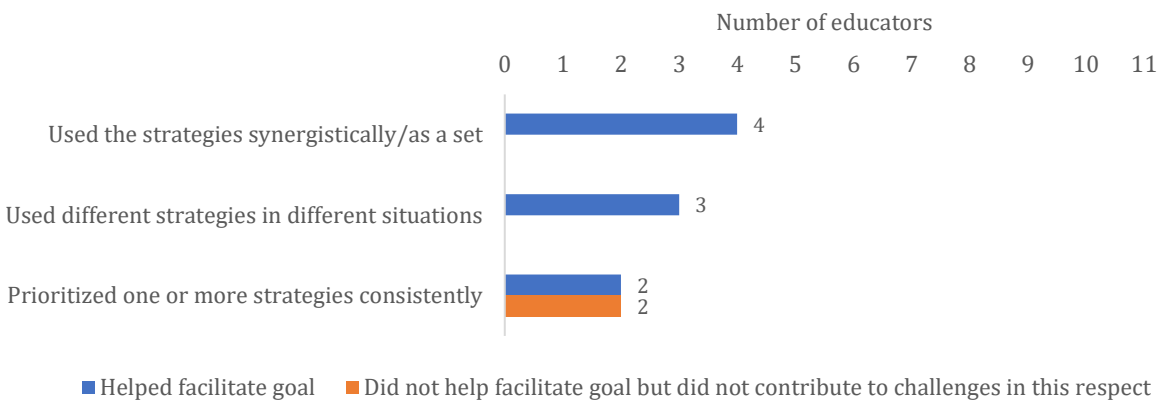
[8] Among the 12 educators who identified <u>other</u> goals of the draft *SciGirls Strategies* (including showcasing diversity in STEM and fostering STEM interest/engagement, confidence, and independent/individual thinking), five prioritized one or more strategies consistently, four used the strategies synergistically or as a set, and three described using different strategies in different situations. Eight of these educators went on to explain that they thought their approach helped facilitate the other goals they had identified. One educator wasn't sure if her approach of prioritizing one or more strategies consistently contributed to challenges faced in meeting the goal she identified earlier (of showcasing diversity in STEM). Another felt that her approach of using different strategies in different situations had *not* contributed to challenges faced in meeting the goal she identified (of showcasing diversity in STEM). Finally, two educators thought their approaches (of prioritizing one of more strategies consistently or using the strategies synergistically or as a set, respectively) *had* contributed to challenges faced in meeting the goals they identified, as follows: prioritizing one or more strategies consistently contributed to challenges faced in meeting the perceived goal of showcasing diversity in STEM ("*I think … we were more successful with the collaboration piece, and so I think I was focusing on our success with at piece, [so I knew that I needed to figure out the how to include Strategy #6 more effectively], because we were succeeding in this other area, that [it just didn't happen]*") and using the strategies synergistically or as a set contributed to challenges faced in meeting the perceived goal of fostering STEM interest/engagement ("*I think it just depends, really, on what I'm doing … it's always case by case. [With some projects, I can use all of those strategies] as a set and it's a wonderful experience, but [with other projects] you have to pick and choose 'Okay, which of these strategies will work today?'*").

Part 5. Perceived effectiveness and impacts of the *SciGirls Strategies*

5.1 Perceived effectiveness of the *SciGirls Strategies*

Figure 31 shows how effective educators thought the draft *SciGirls Strategies* were in impacting the four main areas that TPT envisioned, specifically: engaging girls from diverse racial/ethnic and socioeconomic backgrounds in a culturally responsive way, facilitating girls' STEM identity[9], helping educators address teaching challenges, and helping them reflect on or modify their own teaching practices. Using a scale from 1.0 (*not at all effective*) to 5.0 (*extremely effective*), educators generally thought the strategies were *very effective* in each area.

Figure 31. Educators' median ratings of the effectiveness of the draft *SciGirls Strategies*

Scale from: 1.0 (*not at all effective*)
to 5.0 (*extremely effective*)

	1.0	2.0	3.0	4.0	5.0
Engaging girls from diverse backgrounds (n=19)				4.0	
Helping facilitate girls' STEM identity (n=22)				4.0	
Helping educators address teaching challenges (n=20)				4.0	
Helping educators reflect on/modify teaching practices (n=23)				4.0	

Those who shared a rating of 3.0 or lower were invited to elaborate. In response, two educators each commented on culturally responsive teaching and the challenges they faced (or did not face), as in:

- *I just don't think the strategies are specific enough on race. Race is a huge factor when we talk about who goes into science and who doesn't and I think that could be met head on instead of talking about only cultural identities.*
- *The strategies identify the need to teach in a culturally responsive way, but I would still like to see more examples of how this can be implemented within the program.*
- *Nothing can prepare me for the wrath of transitioning teenage middle school girls and trying to motivate them to think that is REALLY cool stuff to do.*
- *The strategies that were given were helpful but not many challenges emerged during Year 2.*

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[9] As defined by the project, and as shared with the educators in their post-program 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*.

Examples of how the strategies engaged girls from diverse backgrounds and helped educators reflect on or modify their teaching practices

In a subsequent question, educators were invited to share examples from their programs of how the draft *SciGirls Strategies* engaged girls from diverse racial/ethnic and socioeconomic backgrounds in a culturally responsive way[10], and how the strategies helped them reflect on or modify their teaching practices.[11] Examples from educators in both areas are shared in Table 8, below and on the following page.

Table 8. Examples of how the draft *SciGirls Strategies* engaged girls from diverse backgrounds and helped educators reflect on/modify their teaching practices	
Engaged girls from diverse racial/ethnic and socioeconomic backgrounds (n=19)	***Helped educators reflect on or modify their teaching practices (n=23)***
• *We watched a video on the CONNECT² site about culturally responsive teaching strategies … so we took some of those CRTs and tried to figure out how do we even do that … so we touched base every day to make sure that we were … giving them opportunities to share their culture and making sure that we weren't being too biased in how we presented things … and I think we did that a lot through our [diverse] role models … So we just kind of used it … I think constantly coming back and touching on that one, creating an inclusive environment, and using these CRTs, or at least trying to, and making sure we checked our own biases …* • *I think that the strategies are really focused now on realizing that the girls all have these diverse backgrounds and come to the table with so many different life experiences and things like that, and something that we've started to do … in the individual [mentor] conversations, [is] have the girls ask the mentor something that relates to their lives … An example of this [was when we had someone come in who works for the Department of Transportation.] We preload the information, so we have the girls, that day before, learn more about the mentor [and] do their own investigation into what they think she does, what her background is, and develop some questions that they may have for her … one of the girls was like, "There is a bus stop on my street that has very little resources, and there was actually a traffic accident last year where a student died, what can I do to help my community not have that happen again?" So I love that the focus is on the individual, knowing that they all come from these different places, and having them focus on what does that mean to them through all of these lessons and resources and people they're interacting with.* • *That made me think of one of our scholarship girls. One of our funders this year said that they wanted*	• *[The thing we tried to do with everything was] to try to make it relevant, make it make sense … so I think by setting up that safe space in the beginning … basically having the girls bring in two items that were special to them, it could have been a picture or an instrument or whatever … and they made kind of a little shrine, a nice little area that represented them, and so we could look at that and see what their interests were, [and they could see if they had things in common with the other girls] to make those connections … and then we tried to incorporate that into what we were talking about throughout the week … and knowing what the girls were into, we were able to make it more customized and personalized. [Last year and this year we also had a ball with questions on it that we used to get to know the girls and have them learn about each other], but I think also having them make a space that felt like theirs – and that's also where they did their Flipgrid videos – I think it came together really nicely.* • *One of the things that I think was more explicit in the new strategies was the conversation around stereotypes, and so … we didn't explicitly talk about the stereotypes from the instructor standpoint, because it came up with our role models, who talked about some of those stereotypes in their conversations with the girls. That was definitely a place where I was kind of paying attention to see if we needed to talk about it in some form or fashion, but the role models [addressed it]. So that was one reflection point, I would say … I would say it was probably the first time I would have had that conversation explicitly with middle schoolers, [and if it came up in the past it was also probably with role models, but I wasn't looking for that in the same way before this program.] Sometimes it feels like there's a fine line between creating more awareness around stereotypes without creating additional problems.* • *I think one is connecting experiences to girls' lives. I ask kids what they want to be doing and what they're interested in, in my programs, but I don't feel often like I [then plan around their responses].* • *I really love these updated strategies because I really think it's so clear and action-forward how to get the girls to engage with STEM … And because of that, we've changed how girls interact with certain elements of our program. So [with our role model time], we used to do that as a whole camp [with all ages] … [and now we've decided] to do it in smaller*

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[10] The evaluators intended to ask those who did <u>not</u> find the strategies at least moderately effective in engaging girls from diverse racial/ethnic and socioeconomic backgrounds in a culturally responsive way why they thought this was the case. However, all of the educators who completed the follow-up interview indicated that they found the strategies at least moderately effective in this respect.

[11] The evaluators intended to ask those who did <u>not</u> find the strategies at least moderately effective in helping them reflect on or modify their teaching practices why they thought this was the case. However, all of the educators who completed the follow-up interview indicated that they found the strategies at least moderately effective in this respect.

- *somebody from public housing ... so we had four girls [two of whom were in the SciGirls program], one of whom really stands out to me ... she started off saying that she wanted to be a babysitter [or a cheerleader when she grows up]. And as the weeks went on and she started to develop relationships with [the other girls], and [was exposed to] some of their parents who are in STEM careers and she would hear them talking about that, and she saw more of the [role model presentations], what she wanted to be when she grew up kept growing more into a STEM-focused career ... it took all of these weeks for her to go from a babysitter to a STEM career, but it happened. She had a positive attitude the whole time, I really just saw her blossom and grow, and her confidence changed. It was really neat to see that.*
- *I guess I felt like the strategies themselves allow for [engaging girls in a culturally responsive way] ... One thing I took from it was the idea of how to get girls thinking about themselves and what their interests are and how that can relate to science ... how they view themselves, what their culture is, what their values are. But I felt it was really effective with [girls from diverse backgrounds] ... I think all the girls were really interested in sharing what they're passionate about and thoughtful about how science connected to their passions.*
- *I think the whole program just overall, really concentrating on the girls ... changed their mindsets, changed their career trajectory, changed some of their life goals, because they were able to focus on just being young girls together ... exploring together. I think [the role models and the activities] gave them a sense of empowerment, and having an African American leader, even ... I think that supported them just changing their mindset.*
- *[It's about] meeting students where they're at and not trying to push something that they're not interested in, and hearing their voices, and focusing on something that they want to pursue and collaborate on together ... it seemed like all of the strategies were helpful in a holistic approach to working with anyone, really.*
- *When I had the first [STEM professional] come in ... having that person of color who looked similar to them and realizing that they could do something really cool, and something they loved to do, [was great for the kids, since it piqued some of their imaginations].*
- *An example would be when we had a project when we had a guest speaker come in and she ... worked in [engineering] and [she did a project with the girls] and she understood that the girls each have their own understanding of what that project was ... everyone has their own ideas, and being able to collaborate and compromise and think about ideas that would work for everybody in the group was very important ... We're trying to create that environment where everyone feels comfortable working ... and just encourage the girls to work together, I think that's the most important thing, because [collaborative skills will be important to them] in the real world, when you meet people with different perspectives and backgrounds, and you have to be able to work together.*
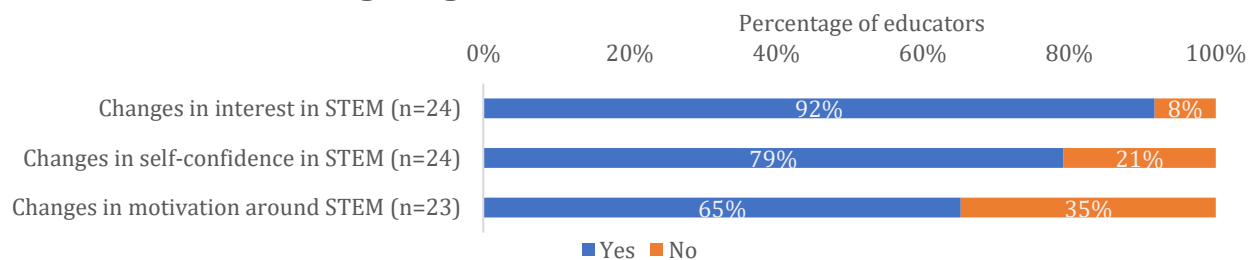
- *groups because it gives the girls more opportunity to ask individualized questions of her. And then also we instituted these reflection pages where they have more guiding questions for the girls to reflect on, a question they may ask the role model and what that means to them, and then we collected those over time so that the girls could walk away with all of their reflections, instead of being so one-off-based. [We want our curriculum] to ask more of the girls [about why this matters] in their lives. So we've done a lot of journaling, we've done a lot of out loud/talking, but putting that to paper, and also finding issues they really care about and bringing those to the table, I think have been really important for us to focus on.*
- *This year we were more purposeful using growth mindset with the girls, really trying to change their thinking of how to work through if there's [a challenge] or something difficult, not giving up ... [We also] gave the teacher some resources [we researched independently] with growth mindset things to say ... to help guide the girls to work through their problems and build that mindset.*
- *One thing that I really loved from the strategies is the addition of growth mindset ... it being more engrained in the new strategies than it was in the original ones. And I think that I took to heart and really thought about how to promote a growth mindset in girls and really all students I'm working with, and the words I used to encourage students ... Going back to that building of a STEM identity, these new strategies have made me think ... how is the work we're doing promoting a STEM identity in the students that we're working with? I think it just made me think more about all the practices I use to engage students and how it contributes to that identification in STEM.*
- *I think that would go back to the STEM identity. I think I spent more time connecting with the girls in conversations while they were working on things ... [I've always focused on growth mindset and what girls can control] but then I went the next step on trying to make them aware of that STEM identity, that I hadn't done before, so I think taking more time with that piece of it is something that I focused more on ... Girls don't realize they have a STEM identity ... even though some of them are interested in potential careers, they don't really identify themselves as scientists or having that ... [so talking about it with them] kind of makes them step back and realize, all of the things that they're being exposed to and doing in these programs are important and make them who they are with that STEM identity, so I think it gives them ownership, which at this age is incredibly important.*
- *I think I was really excited about creating that collaborative space and I think I was noticing where the youth were at ... pushing them, stretching them, but also kind of figuring out when to reset ... I was thinking about that as a dance, getting young people to kind of stretch. And I was also thinking "I really need to reach out to more community members that look like the youth I'm working with" and making sure that I'm bringing them along too.*
- *I would say that connecting it to the girls, it gave it a different take, not just in STEM, but when we talked about their different interests [or hobbies] ... and how in one way or another we can connect it back to STEM, again it made it more real-world for them.*
- *It really changed my perspective about how big of an influence you are, because these girls, they come in every day and they decide whether they like you or they don't, but for me it was very surprising ... getting to know the girls ... they were comfortable, they were asking questions about where you're from ... so to me it was always about being positive all the time and being open to hear whatever they had to say, because each girl has a different way of interacting with people. You have to have that firmness ... but you don't want to be too firm and [push them away]. It was a balance.*

5.2 Whether educators thought the *SciGirls Strategies* facilitated changes in girls' STEM interest, self-confidence, and motivation

Figure 32 shows that nearly all of the educators thought the draft *SciGirls Strategies* facilitated changes in girls' interest in STEM, while four-fifths thought the strategies facilitated changes in girls' self-confidence in STEM, and two-thirds thought they facilitated changes in girls' motivation around STEM. These three areas of questioning were drawn from the project's definition of STEM identity, which was shared with educators at multiple points over the course of *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.*

Figure 32. Whether educators thought the draft *SciGirls Strategies* facilitated changes in girls' STEM interest, self-confidence, and motivation

Percentage of educators

Changes in interest in STEM (n=24)	92% — 8%
Changes in self-confidence in STEM (n=24)	79% — 21%
Changes in motivation around STEM (n=23)	65% — 35%

■ Yes ■ No

Though not shown in Figure 32, just under half of the educators (46%) said they thought the strategies facilitated changes in all three areas (girls' STEM interest, self-confidence, *and* motivation), which together contribute to STEM identity, as defined by the project.

Educators' examples of changes they observed in girls' STEM interest, self-confidence, and motivation are shared below.

> **Examples of changes in girls' interest in STEM (92%)**
> - *These girls came in pretty primed for STEM to begin with, but it was exciting to see their understanding of what STEM means expand. Exposure to so many areas of STEM and discussions about how it is used in nearly every profession shifted some of their ideas about what a "scientist" is and that they could do STEM professionally in so many ways.*
> - *The program opened the girls' eyes to such a broad opportunity of STEM in the world. One of the role models we used was a Food Scientist that develops different flavors of cream cheese. After talking to this role model half the class wanted to become a Food Scientist. So it is really interesting to see the girls realize how much opportunity the STEM world holds …*
> - *One of our girls got very into building a video game on Scratch on her computer and wanted to show and test the game with both us as educators and her peers when she didn't have much tech experience beforehand.*
> - *There was a definite increased level of participation and engagement by the girls. More intentional focus on relatable subject matter that generated a deeper connection to STEM. More excitement and willingness to try new experiences.*
> - *I saw an increased interest in possible career choices and the idea that STEM is social in nature …*
>
> **Examples of changes in girls' self-confidence in STEM (79%)**
> - *The best example of this is the parent night at the end. The girls were in teams and each team presented a summary of one day of the camp (activities, lessons learned). The group that summarized the physics day was amazing because many of them had struggled with the activities (using a wave simulator and*

calculating wave height) during that day of camp ... They struggled a little during the presentation but pushed through confidently and were able to explain it to the parents with charisma!

- *One of our most timid girls who very rarely even made eye contact presented what she learned to the entire group and their families on the last day. It was amazingly rewarding!*
- *During project-based learning, I saw girls take the wheel on discussing roles that their peers would be most effective based on their strengths. Girls really began to exercise their leadership ability.*
- *They were not super confident in the first activity and took a bit to get going on it....but by the end they were persistent in trying to figure things out and jumped right in to the challenge*
- *As they continued doing the activities, they became more confident when they had to go back and add to their experiment.*
- *Girls who were unsure of themselves and their academic level (primarily reading) saw a big change because they were able to be verbal to work through problems. It made them feel successful because we no longer focused on their weakness as a learner but on their strengths.*

Examples of changes in girls' motivation around STEM (65%)
- *Since our lessons are generally heavy on conservation messages, I noticed that the girls felt empowered to make the changes they wanted to see in the world by pursuing a career in a STEM field. Some girls even decided to marry two career goals/interests because they saw the value in pursing both.*
- *The biggest change that I saw was the girls putting more value on STEM education. Meaning they started seeing why math and science class/skills are important. They started seeing applications to what they were learning, and I think/hope it motivated them to engage more in those classes in school.*
- *The more the girls learned about the different aspects of STEM and the different opportunities in STEM, the more they were interested. At the beginning of the week the girls were much more timid about topics, but by the end of the week they were so excited to find out what was next. It is really interesting to see them get so involved in the different aspects of STEM. Where before they didn't even realize how important STEM is to everyday life.*
- *When we start to explain the program/activities using the updated strategies, the participants seemed more eager to participate and learn. The girls often looked forward to the next activity, wanted to do more.*
- *The collaboration between the girls was increased. They were bouncing ideas off each other and helping each other solve problems as they arose.*
- *Many of the girls were excited to discuss STEM when they could see their favorite celebrities' involvement. For example, celebrities who endorse products that could have STEM inspiration, such as makeup/chemistry.*

Strategies educators found most important in facilitating changes

Those who thought they had observed changes in girls' STEM interest, self-confidence, and/or motivation through their use of the draft updated strategies were asked which strategies, if any, they found most important in facilitating each change. Figure 33 on the following page shows that these educators pointed to some strategies more than others as facilitating impacts on the three aspects of STEM identity. Specifically:

- In terms of facilitating **changes in girls' interest in STEM**, half of the educators pointed to Strategy #6 and about a third pointed to Strategy #2, with other strategies being cited by groups of about a fifth or less.

- In terms of facilitating **changes in girls' self-confidence in STEM**, half of the educators in each case pointed to Strategy #3 and Strategy #5, with other strategies being cited by groups of about a tenth or less.

- In terms of facilitating **changes in girls' motivation around STEM**, more than a third of the educators pointed Strategy #5 and less than one-third pointed to Strategy #3, with other strategies being cited by groups of about one-fifth or less.

Figure 33. Draft *SciGirls Strategies* educators found most important in facilitating changes in girls

Legend:
- Changes in STEM interest (n=20)
- Changes in STEM confidence (n=15)
- Changes in STEM motivation (n=14)

Percentage of educators

#1 Connect STEM to girls' lives
- 20%
- 7%
- 21%

#2 Authentic opportunities
- 30%
- 13%
- 21%

#3 Growth mindset/embrace struggle
- 20%
- 47%
- 29%

#4 Identify and challenge stereotypes
- 13%
- 7%

#5 Collaboration
- 20%
- 47%
- 36%

#6 Diverse role models
- 50%
- 13%
- 21%

All of the strategies
- 5%
- 13%
- 21%

Aspect of the framework
- 10%
- 7%
- 14%
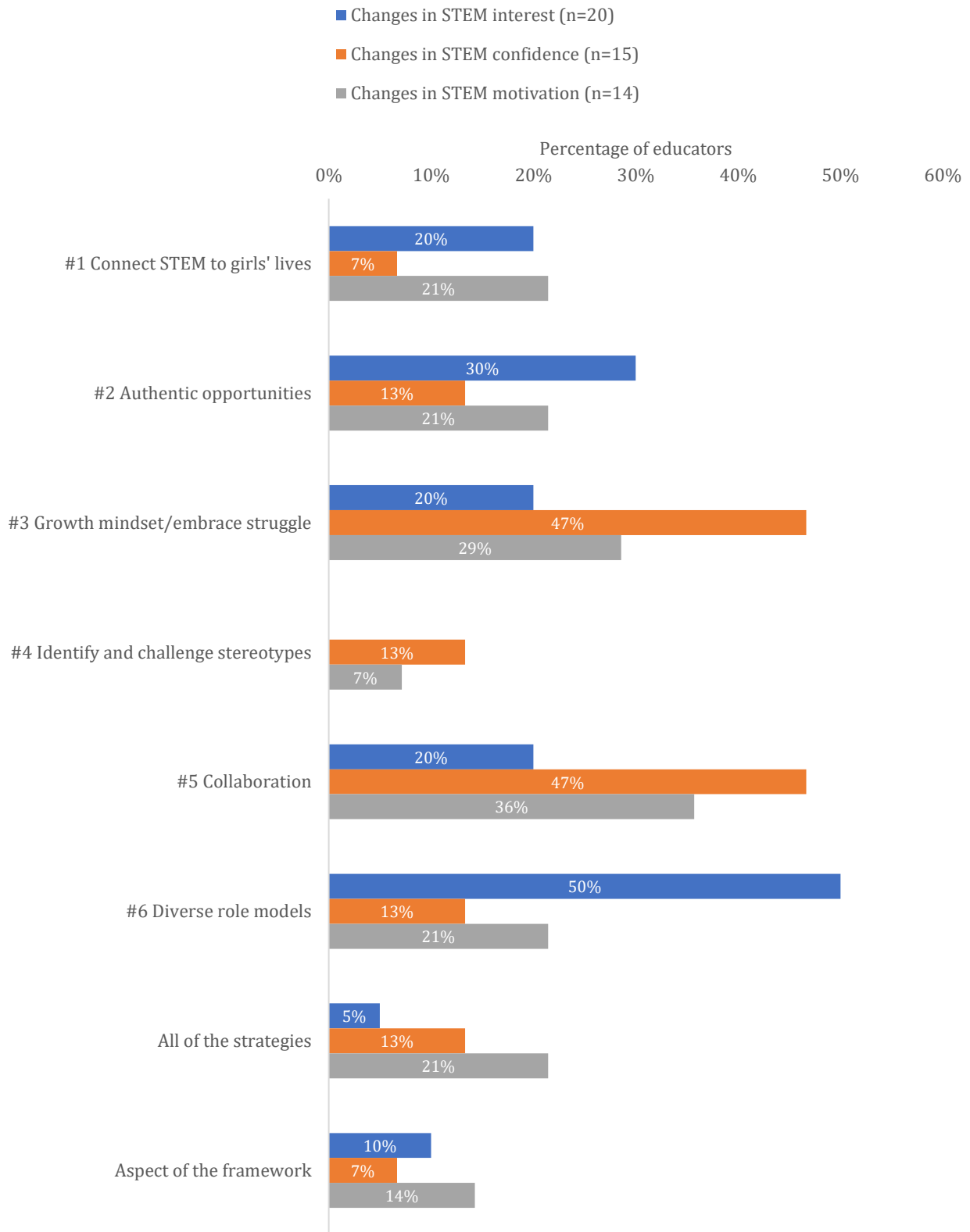
Part 6: Barriers or challenges in using the final *SciGirls Strategies* and recommended support

6.1 Barriers or challenges in using the final *SciGirls Strategies*

Figure 34 shows the barriers or challenges educators said they expected to face in using the final version of the updated strategies. More than half of the educators declined to elaborate or indicated they had no concerns. About a fifth each shared implementation challenges they experienced and/or thought they might experience challenges in using the strategies with other youth, for example, mixed-gender groups, different ages, and different levels of experience with STEM. Less than one-tenth shared other concerns. Examples of educators' responses are in Table 9, below and on the next page.

**Figure 34. Anticipated barriers or challenges in using
the final *SciGirls Strategies* (n=24)**

Percentage of educators

No response	33%
No concerns or challenges	25%
Shared implementation challenges	21%
Using the strategies with other youth	17%
Other	8%
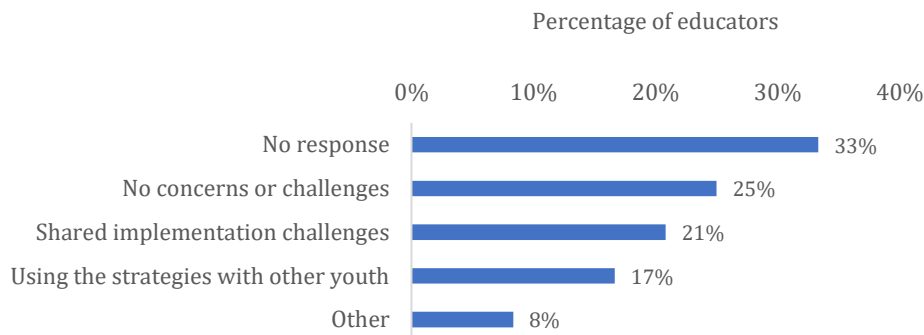
**Table 9. Anticipated barriers or challenges in using the
final *SciGirls Strategies* (n=24)**

No concerns or challenges (25%)
- *No concerns - easy to implement and well structured*
- *I don't think so.*

Shared implementation challenges (21%)
- *Exposure to environments not found in or around the city. Our goal will be to include more field trip experiences during Fall and Spring to expose our scholars beyond classroom walls and technology. [Also], when I started to use the program, I ran into a couple of snafus. They told me to log in to SciGirls … so I could see the lessons online, but I wasn't able to do it. I did however find some of the online [materials that were] open to the public … but I would have liked more access, to show more videos [and access more lessons] … I didn't want to make a big deal about it though.*
- *I did have some concerns when using the SciGirls activities as some were not as well described and left myself and the kids stumped on how to execute the activity.*
- *… it was more of the logistics (scheduling visits with scientists, getting the [surveys], and knowing when the deadlines for everything was) that played a barrier in the project.*
- *A challenge would be to continue to keep the girls engaged, and not have them feel as if they already did the program. Keep activities interesting.*
- *I think my biggest challenges … has to do … with parental involvement [particularly in low-income communities] … Even when we did our family event, a lot couldn't come because they were working.*

6.2 Suggested support to help implement the final *SciGirls Strategies*

Figure 35 shows educators' suggestions regarding things TPT might do or provide in order to help them feel more prepared to implement the final *SciGirls Strategies*. Three-quarters of the educators suggested TPT provide or add to specific resources, for example making graphics for each strategy or tip that could be shared on social media, providing benchmarks for future *SciGirls* programs, and creating printed and online guides aligned to the updated strategies. Two-fifths each requested trainings and/or examples of or tips for using the strategies. Smaller groups of about a tenth each said they thought it would be helpful if TPT would facilitate educator connections, help their programs connect with STEM professionals, or gave other suggestions. Examples of their responses are shared in Table 10, on the next two pages.

**Figure 35. Things TPT might do or provide to help educators
implement the final *SciGirls Strategies* (n=21)**
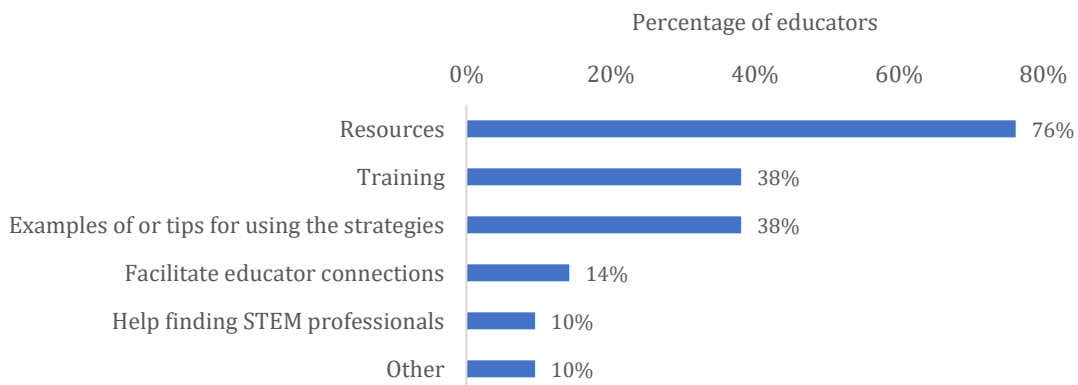
Table 10. Things TPT might do or provide to help educators implement the final *SciGirls Strategies* (n=21)

Resources (76%)
- *One graphic per tip [or per strategy] that they could share on social media … because if things are a little more bite-sized, people could engage on that or have a conversation on that. Sometimes I think things can be overwhelming for people. And with that being said, I love how much [information they've provided] in terms of research, but I think some of that needs to be toned down a little bit in the final resources. [They need something] where people can glean the strategies and not get lost in the research. [The research] is important [but I think it should be] available in the appropriate place.*
- *One thing I liked about the [SciGirls Seven] is just the basic structure. So you would have the strategies, then you would kind of explain the strategies or give tips, and then you would put the research. For me, the way that it was divided up before, it seemed to be easier to follow for those who were not [coming to them with] an education background. I think you could state the strategies, explain and them put research separate from [the] strategy and explanation.*
- *[The Strategies and Tips] document had a lot of content, and starting with a lot of the research and background took my energy away from reading the strategies, so I think the presentation – depending on the audience – will be helpful, and visuals [are always helpful].*
- *Educators need things to be quick and simple]. And I hear that a lot, no matter how formal or informal the educator is. They want [things] that are scripted and packaged, [and/or they want things with bullet points].*
- *I think that for educators who are familiar with the [SciGirls Seven], it might be a little bit of a challenge [to switch to the updated strategies]. So if there's a document that provides – [you had that picture with the arrows between the original and updated strategies] – and that was helpful to me to start to rethink how I used the new strategies. So that would be my only suggestion, to keep that [in some form, or to expand on that image with more information about the relationship between the old and new strategies]. Having the research behind and further information of how they connect would be really useful, [especially in terms of training other educators on the updated strategies].*
- *I know that in the last month or so they sent out how the old education guides matched to the new strategies, and I loved that, that was really great, so maybe more examples of that? Just because if you've been using [the strategies] for a while, you can get stuck in the old ways you were doing it, so just ways to constantly be pushing yourself to think about the new strategies in terms of the older curriculum and things like that.*
- *I've loved having [the strategies] printed in the book, and I don't know if they plan on doing that again … but having that booklet where you can write [in it] is incredibly useful from the perspective of a trainer and an educator.*
- *With the online activity guides … will they go back and align to the new strategies? … [Also], having all that stuff online and easily accessible.*
- *Provide a list of free field trip resources per state, to be used with the activities to enhance scholar learning … [Also], for planning purposes, please provide an activities outcome guide for teachers only. This will assist with planning time accurately. Some experiments were longer than the plan listed. Provide a [written] component explaining different outcomes that may occur as a result of scholar error … I think all the activities were laid out wonderfully, but I think for some, I would have just liked a little cheat sheet guide [providing the anticipated impacts on girls of each of the activities].*
- *Having more how-to videos on how to do all [of the] activities to make it easier and more effective for the educators to do them with the girls.*
- *Maybe film [someone from TPT] explaining the strategies in a video.*
- *Provide more ready-to-use resources and support documents. [Also], I'm sure they're already doing this, but making sure [the new Mentor Moments] are diverse, because not everyone has access or time to have mentors come in. [It would also be helpful to have accompanying bios for each of the diverse Mentor Moments] … it could be on a one-page document with a picture of the STEM mentor and then her college and degrees (which promotes girls thinking about which colleges they might want to attend), where they work or have worked, Interesting facts (to help the girls make personal connections with them; i.e. favorite color, hobbies, foods etc.), who inspired them or how did they work through challenges (growth mindset) when earning their degree or in their profession, and then a link to a video (Mentor Moment from a SciGirls episode or one of them at work) so the girls can see a snapshot into what they do on the daily at work.*
- *I think that maybe some benchmarks throughout the program, for what is expected – [for example] at the beginning, mid-point, and end, what's expected and what's going to keep us on track, [both in terms of what we might see with our youth as we use the strategies and keeping track of the research and evaluation elements]. With the strategies, it's all really helpful, but it is all very big picture stuff, so for me to stay on track it would also be nice to have some clear expectations on the details and when they're expecting that stuff. So "by this time [in the program] you're having this mentor come in," that kind of thing. [And maybe they could share sample itineraries and expectations for shorter programs and for longer programs.] That would be so helpful.*
- *It would provide me greater support if SciGirls or even TPT started translating their programs and pamphlets in Somali. It was difficult explaining to parents what SciGirls is besides saying the coined term "STEM" which makes every parent think that "Oh this is a good program for my kids."*

Training (38%)
- *Do you provide [training or information on] cultural responsiveness, or behavior management, or social-emotional learning? Those are the kinds of things that kind of get left out a lot in trainings … although I'm wondering if that's a TPT thing or each individual organization's own responsibility in learning and knowing when they're working with kids.*

- *More training on racial bias and intersectionality.*
- *If they could put on a culturally responsive training, that would be fantastic! It's not really a tangible thing, it's not black and white, or something you can just read about.*
- *I'm an educational leader, so I always love PD. Any opportunity that you can get people, especially the teachers that are working, just thinking about [the practice of teaching science] ... [I would also love to attend a local training with other people in my part state of the country.] ... And also some online seminars, 30 minutes, so it's not too long ... it would be great to be able to give those teachers professional development hours, because it will serve both capacities.*
- *Connecting them to the existing material and the existing videos. Putting them together in a packaged model that we can easily point to this particular activity and this particular episode or this particular area of STEM ... as a path to connect to these strategies would be helpful. And you could do that, as you're developing the training model. I'm looking forward to seeing what this looks like for the next round of strategies.*

Examples of or tips for using the strategies (38%)
- *Keep giving more tips about how to implement the new strategies*
- *Try to provide more suggestions for various age groups for how to apply strategies to allow them to be more flexible to the group someone is working with.*
- *For the visual learners, [if you could go online and watch a video of] a scenario of Strategy #1, a scenario of Strategy #2 ... a reenactment of how to do this in the classroom setting or your afterschool group setting – just showing examples.*
- *[Short] videos of [educators] in action, delivering an activity that highlights, you know, these two strategies are more highly visible here ... that might be helpful.*
- *Just more examples ... I love videos of things, of how people are doing it well, or resources. That might come out more in the guides that they put out ... Some things are great in theory, but then when you actually do it yourself you're like, "That's not feasible," so how to make it more feasible? [I would like] examples of people doing it well ... I just think more practical information on how to apply the strategies would always be helpful.*
- *It might be nice to have some examples of what it looks like to implement the strategies. Some of them were easier for me, because they seemed natural to what I was already doing, but ... some kind of framework on implementation, on how to put those pieces together, would be helpful. They could do this as part of the training, or could provide a handout.*

Facilitate educator connections (14%)
- *I love a lot of support ... [talking with] other educators might be cool too, that are also in the program. So a Facebook group or [something like that].*
- *It would be great to have a SciGirls-for-your-city event, and maybe have someone special come and talk about SciGirls ... Something as a group to bring them together.*
- *Maybe once programs are ready to start ... somehow, the different educators are connected, and then on their own they can ... stay connected amongst themselves. [This might also be information TPT could share on the local level,] like, these three places are doing SciGirls in this county, so you connect and know that you're kind of in the same area. It would be great to connect groups, have our girls meet up with another group and share what you've been doing and how you've been doing it. Sort of like a pen pal, but in relation to the SciGirls! It would be great, even if it's not from TPT, [to connect with local educators who are doing these kinds of programs, so we can see who they're working with and the role models they're bringing in], so we're all kind of dipping into the same pool or sharing resources.*

Help finding STEM professionals (10%)
- *Sending a list of places in the area where it would be easy to find female stem role models.*
- *Continue to find female role models with STEM careers and/or in the STEM field to be involved.*

Other (10%)
- *If TPT could serve as direct professional consultants where challenge come to a situation, that would be great. [Also], if there is someone who is a resident expert, that people could tap into if they do struggle or have an issue, there could be call-in opportunities or possibly have one-on-ones to talk through [challenges an educator might be facing].*
- *We want to continue to offer programs for underserved students and their families, but we are always looking for funding to do so. Donors want to see outcomes and know how we are evaluating our work. If there would be some way to have a report or link from this SciGirls CONNECT[2] program to show them how we function and that we were part of this project, it could be helpful in requesting funds ... I don't know if there's anything that can be done [in terms of TPT helping us provide accountability to grantors], but I think that would be helpful.*

Part 7. Suggestions for finalizing the *SciGirls Strategies*

Educators were invited to share revisions and additions to the draft *SciGirls Strategies* in the formative survey and follow-up interview. They were also given an opportunity to "think outside the box" and share other recommendations related to the strategies as a whole, individual strategies, the framework for strategy development, 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.[12] [13]

In response, one educator suggested a revision to the draft *SciGirls Strategies*, one shared an addition, and five shared other recommendations. Given the relative lack of feedback provided in direct response to these questions, the evaluation team reviewed each educator's full set of 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 and follow-up interviews are below, in Sections 7.1 – 7.3. Additionally, educators who completed the follow-up interview were asked if they had suggestions for how TPT could (better) incorporate cultural responsiveness throughout the *SciGirls Strategies* or the framework for strategy development. This feedback is in Section 7.4.

7.1 Proposed revisions

Throughout their surveys and interviews, a number of educators proposed revisions to the draft *SciGirls Strategies*, including rewording Strategy #4 and clarifying aspects of Strategies #4 and #5. Examples of their comments are in Table 11, below and on the next page.

Table 11. Suggested revisions to the draft *SciGirls Strategies* (N=25)
#4 Encourage girls to identify and challenge STEM stereotypes and bring their true selves to the learning space   • *Rephrasing #4 to be a little be looser, I think. Be a little bit more like, I think the girls can come to the conclusions, they can bring themselves to the learning environment … because some of them, they want to be nerdy … I think we kind of struggled with the way this strategy is phrased because, the way it's phrased is to acknowledge and explicitly counter stereotypes about women in STEM, and we did that, we had conversations about that, but I don't know that I necessarily agree with that statement, because countering a stereotype means saying it's wrong, and there are also a lot of really positive stereotypes of women in STEM, and I think this strategy, kind of the way it's phrased, is like "Let girls come to that conclusion on their own," but I know when I was a little girl, having female role models who were okay with being dorky and nerdy and seeing that they were still cool, that was a positive influence in my life. It also says something in the Tips document like "Make sure that they feel like they can still be girly." We had some girls that were not girly. Those are good examples, but [I think the strategy should focus] more on their selves than the stereotypes.*   • *#4 (Regarding STEM stereotypes) - Encourage girls to be their own authentic selves and be proud of who they are, but show that in addition to working independently on a computer (a science stereotype) there are lots of other options. I think the overall message here is that the girls have a role in shaping their future and they can follow whatever path they desire regardless of any stereotypes that exist. (And if they want to be the stereotype that's ok too!) [So] I'd like to see #4 reworded with a more positive message … I think, while it's important to identify … stereotypes within the STEM world, it's not always, in my experience, the most helpful for encouraging girls to be more participatory in that realm because … the STEM stereotypes that exist are … male*

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[12] The evaluation team reviewed each educator's full set of responses to compile a list of tips that they incorporated into their use of the draft *SciGirls Strategies*. These tips, which are shared in Appendix 2, were provided to TPT prior to the completion of this report, to aid in their work on the final *SciGirls Strategies* and accompanying materials.

[13] The educators who completed the follow-up interview were also asked if they found any of the draft *SciGirls Strategies* redundant, to which all 23 educators said *no*.

dominated and you work in a lab with a lab coat and you don't really have much interaction with other people … and while that is obviously not the case for every field within STEM, sometimes it is, and sometimes that is what someone wants to do, so that's why we approached this one more to expand the girls' horizons than to specifically counter what's out there … I don't think it's entirely necessary to challenge STEM stereotypes as this may be what the [girl] is striving for. I think what's more important is for girls to be authentic and confident in their "true selves" as being capable of whatever they work towards.

- *I think it's important to identify STEM stereotypes, but some girls may be striving to achieve those stereotypes. I think a better way to word this strategy would be: Encourage girls to bring their true selves to their STEM identity and learning space regardless of any existing stereotypes. So in other words, they can identify and acknowledge stereotypes if desired, but starting with a blank canvas and knowing that they are capable of whatever they choose in whatever capacity that career allows them is a better message than trying to contradict stereotypes.*

- *Something about #4 … I feel like it's kind of an old way of thinking … And I know the reality, I know there are stereotypes out there, but I'm not seeing it in the classroom as much as I used to … I teach STEM to 3rd, 4th, and 5th graders every day, and I don't see that at all. Maybe I'm not evaluating them properly. And I know it's still there, in careers, in professions, but I feel like there's a shift happening, in the last 4 or 5 years. [So] I feel like you could still get that point across, but maybe with a different wording … I don't think it's viewed as nerdy or geeky to do STEM anymore, especially with the technology part of it and the coding, I just feel like it's more engaging for kids now because of video games and all of that, it's more active than regular learning. Something about how it is worded with stereotypes I don't think is "friendly" in this strategy. I think the bring your true self is important. I am not sure how to reword it but I don't want to bring up an issue that the girls are not aware of already.*

- *I think the only one that I was unclear about was [#4] – which I get is trying to be general enough that it can apply in a lot of situations. But that's the only one I would maybe tweak the wording of, because I'm not sure what "true selves" is supposed to. Or maybe just explain "true selves" a little more … Does that mean identity, personality, possibly both? I think it's meant to mean both but it's a very general term.*

- *There might be some questions on what the girls' true selves and learning space are. How do we encourage them to bring their true selves into this space and how does the educator make a truly safe space for them?*

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

- *Though much of STEM is collaborative, there are many aspects of STEM that are not, and I feel it's important to show the girls all options not just the "sexy" science ones. I do agree that generally in whatever field or career one chooses there is value in being able to work together cooperatively as a team but also letting SciGirls know that sometimes you work alone in a lab is ok too.*

7.2 Proposed additions

Throughout their surveys and interviews, six educators suggested TPT make additions to the draft *SciGirls Strategies*. One suggested incorporating language from the *SciGirls Seven* into Strategy #2, while another proposed incorporating a focus on critical thinking (a strategy that was removed in the transition from the original *SciGirls Seven*). A third suggested adding a focus on local STEM professionals to Strategy #6, and three proposed other additions to the set of strategies. Their proposed additions are in Table 12, below and on the next page.

Table 12. Proposed additions to the draft *SciGirls Strategies* (N=25)

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

- *I think something about "hands-on STEM" needs to be in this descriptor, like: Provide authentic opportunities through "hands-on STEM" that mirror the practices of STEM and help girls develop their own ways of exploring and sharing knowledge.*

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

- *I think of [the critical thinking strategy from the original SciGirls Seven] as part of #3 now, where they overcome challenges, because that requires critical thinking.*

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

- *The only thing I can think of is that [you might suggest] that the role models live in your area. Although in another program I do, [we use Skype to connect with role models] and it's not a big deal.*

Other additions to the set of strategies

- *I don't know if you need to necessarily add this to the strategies, but I think one thing I saw from the strategies is when you use them, it reinforces some other things [for example when I saw girls learn about different career paths, it sometimes sparked*

7.3 Other recommendations

Throughout their surveys and interviews, 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, #3, and #4; STEM identity; culturally responsive teaching strategies; and the presentation of the final *SciGirls Strategies*. Although these subjects are discussed in greater detail throughout this report, examples of educators' comments in each area are in Table 13, below and on the next page.

Table 13. Other recommendations or factors educators thought the project team might keep in mind as they finalize the *SciGirls Strategies* (N=25)

#1 Connect STEM experiences to girls' lives
- *Gaining more knowledge about the girls' interests and past STEM experiences would be helpful to incorporate [Strategy #1] better.*
- *Coming up with a list of questions that would guide [Strategy #1] would be helpful.*

#3 Promote a growth mindset in girls to help them embrace struggle, overcome challenges, and increase self-confidence in STEM
- *I feel like providing some short growth mindset types of activities OR providing sample comments or statements for the teacher to use to build this would be helpful.*

#4 Encourage girls to identify and challenge STEM stereotypes and bring their true selves to the learning space
- *This isn't a change or addition to the current updated strategies but "Identify/Challenge stereotypes" is a little difficult with youth who identify as African American/Somali American as they are not sure what stereotypes are out there that is placed upon them culture-wise. Gender-wise it is easy to identify but my girls wanted to connect it somehow to their culture to make them care more. Maybe in the next webinar, to think of some examples we can show to the participants.*
- *More ideas on how to bring their true selves into the learning space would be helpful.*

STEM identity
- *I think I spent more time connecting with the girls in conversations while they were working on things … [I've always focused on growth mindset and what girls can control] but then I went the next step on trying to make them aware of that STEM identity, that I hadn't done before, so I think taking more time with that piece of it is something that I focused more on … Girls don't realize they have a STEM identity … even though some of them are interested in potential careers, they don't really identify themselves as scientists or having that … [so talking about it with them] kind of makes them step back and realize, all of the things that they're being exposed to and doing in these programs are important and make them who they are with that STEM identity, so I think it gives them ownership, which at this age is incredibly important.*
- *Though we got to know the girls all pretty well, I think for next time it would be useful to review the pre-surveys a little more in depth to really understand where the girls are starting in their STEM identity. Or maybe even facilitating a discussion about STEM identity as a group and what that means.*

Culturally responsive teaching strategies
- *Maybe focusing on how much of it is on the facilitator and how much is on creating an environment. Breaking it down [in terms of which strategies are harder or easier to facilitate, which ones are easier or harder to do in activities]. Like, cultural responsiveness, that's hardly on the facilitator and the activities they choose, but … [in terms of] connecting it to the students … I*

7.4 Suggestions for incorporating cultural responsiveness

The educators were asked to share suggestions for how TPT might (better) incorporate cultural responsiveness throughout the strategies and/or the framework for strategy development. Figure 36 shows that more than a quarter thought the strategies and/or framework should emphasize the importance of listening to and connecting with youth and families. More than a tenth each commented on using culturally responsive teaching with Strategy #6 or requested examples or tips. Smaller groups said it had more to do with the leader than the strategies or shared other response. Finally, about a third of the educators instead described ways they thought cultural responsiveness could be incorporated into (existing and suggested) *SciGirls* resources. Examples of their comments are in Table 14 on the following two pages.

Figure 36. How educators suggested incorporating cultural responsiveness (n=22)

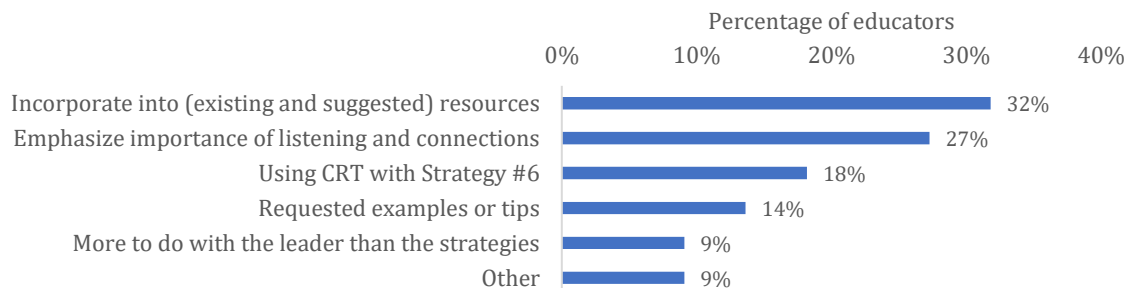|	Percentage of educators
Incorporate into (existing and suggested) resources	32%
Emphasize importance of listening and connections	27%
Using CRT with Strategy #6	18%
Requested examples or tips	14%
More to do with the leader than the strategies	9%
Other	9%

Table 14. How educators suggested incorporating cultural responsiveness into the final *SciGirls Strategies* or the framework for strategy development (n=22)

Emphasize importance of listening and connections (27%)
- *I don't know. I do think, and I think it was in the webinars, just thinking about your own biases and what values you hold dear and trying to step out of yourself and out of that perspective and into someone else's shoes … but I don't know exactly how to do that, aside from getting to know each girl better and learn about their families. And maybe even having … physically seeing where the girls hang out … and what kinds of things are in their neighborhoods … I don't know, without invading privacy, how the girls could share more about what they're about …*
- *So much of that comes from the open-endedness and understanding the audience that you are engaging, and it's so different across different organizations and spaces. I don't know that I have a suggestion, other than being explicit on being flexible … if you're paying enough attention to hear what [the girls are telling you in response to what you have planned] and being adaptable in your approach, to be able to let them figure out where to take it.*
- *Cultural responsiveness is so tricky … we want to get some methodology that's agnostic of the facilitator's background, but we can't – in my opinion – you can't overlook the fact that it's not … so I think cultural responsiveness, particularly in the space of all kinds of diversity, it would be very important to have a conversation [as appropriate for the different age groups] of what diversity means, because I think particularly in a lot of educational spaces, it gets broken down into just ethnic and racial diversity – and definitely gender in programs like the one we were in – but [we should also consider things like] ability level, linguistic level, immigrant experiences. There are so many levels of diversity that anybody could have a diverse background and feel like they're part of a diverse tapestry, whether you're a single child or one of multiple. You could figure out a way to let individuals know they have a unique story and that unique story contributes to the tapestry of diversity, and I think letting them know that there's a wealth of experience there to connect them to their activity at hand …*
- *I think that the thing that I deal with the most is socioeconomic differences, rather than ethnic differences … I think that you're touching on some of the ways that you can encourage that too, in [these strategies]. So, connecting it to their own lives, they would be more willing to, maybe more excited to learn about something, like "I could do that!" And then they have a little bit more motivation to get there. And just helping them to overcome challenges in their life, [because a lot of our kids come from families that face a lot of challenges]. I think you're hitting on those things already, I think you hit them well in the draft [strategies].*
- *What I think is that … every situation is unique, and that you need to look at the specifics of that community, of that situation, and then just be respectful of where those people are coming from, and not to impose your ideas and thoughts too strongly on them, but to engage and find ways that what you're bringing to them can be assimilated within that culture.*

Using CRT with Strategy #6 (18%)
- *I think I just needed a little more support. The area that I struggled with the most was finding that authentic scientist [to come in as a role model] and getting it to work with [our meeting time] and the logistical scheduling of all of the pieces. [I didn't have as much trouble locating them to begin with, it was more to do with] matching the youth schedules with these professionals' schedules. [TPT might be able to help] by setting up the expectation with the people in the [FabFems] database that [we would ask them to meet] in the evening or the afternoon.*
- *I think the main thing is just bringing in role models, especially from their area, because they'll see people who are kind of like them, doing things that are important.*
- *The girls are at a point in their lives where they have a lot of questions about how to get to a certain career, like if they're going to start high school soon, [they have a lot of questions], and we don't necessarily have the answers, so if we could bring in different [role models], they would be able to answer questions and get the girls more excited about what they want to do.*

Requested examples or tips (14%)
- *I think they provide some examples, [and those videos were helpful, so maybe if they had videos of specific examples and scenarios], where somebody was in a situation where something was uncomfortable, like it is, and you have kind of adapt and learn from it. I think videos are great because you can read all of these examples, but actually seeing how someone shifts in the moment would be really helpful … [either a video of someone in the classroom, or someone recounting a situation, or even someone acting it out.] Just something to help prepare you, because it does happen, you're in the classroom and someone says something or you say something and you're like "Uhhhh, that's not really culturally sensitive" … [for example if someone says something about someone's lunch, like "Why would you eat that?" then you step in and say "Hey, let's not talk about it that way, maybe it's something new to try in a different culture."]*
- *I don't know how you could tweak [Strategy #1], but it would be helpful to have examples of ways to be inclusive in a group way, [as opposed to an individual girls' way], without making people feel grouped.*
- *I know there are many different backgrounds these girls could have … but we have some set groups of girls, like we have Latina girls and we have Black girls, we have Asian girls, and I know that culture is so different among these subgroups, so what have they found that has been so important to these groups? I know that's not a blanket statement like "All Latina girls enjoy ___" but in their research, what have they found? … Sharing more knowledge and tips [would be helpful] … Because I understand what culturally responsive education is, but I don't know what specific strategies I should do are, and maybe that's the point of it, that I should get to know them, but with having [different girls in each program] there's not a lot of time to do background digging, so just what are some of the ones that always come up and … what are some of the tangible strategies around that?*
- *Maybe examples of things to say, that are generic enough that people can pull that little piece of it and plug it into the situation that they're having … because I think people are going to have a harder time with that and/or they're going to be sensitive to it*

and they're going to want to make sure they're saying the right things, so they're not going to be a risk-taker in trying out different statements, so I think offering examples … would give people comfort for that. What they could actually say though, I don't have that nailed down!

More to do with the leader than the strategies (9%)
- *I think because of who the people are who were leading it this year … [this year our educator] put her all and all in it. [So it's a question of finding] the right leaders.*
- *I think it's really [about] how the leader or the coordinator does the delivery or the conversation around that*

Other (9%)
- *I think that the biggest problem you would have with socioeconomic diversity would be [that] a lot of STEM requires college degrees right off the bat, and [for] a lot of the kids [in our area] … college might be a far reach for a lot of them. But there's a lot that they could do with science and STEM that doesn't include college, and I think creating that bridge is really important.*
- *We have different types of Hispanic families and different types of Native American families, and the biggest differences are more class than socioeconomic. [I don't know how you would incorporate that into the strategies], but I would say that would be the biggest difference amongst these girls.*

Incorporate into (existing and suggested) resources (32%)
- *With [the SciGirls Seven, I liked] how they did the booklet and really deconstructed each [of the strategies]. I think if they did something similar to that, that would be incredibly helpful.*
- *I think it would be hard to actually put in the strategies, I think that maybe it would be better to put in a place of support for educators, like, read some articles about it, understand – it just really depends on your background, if you have experience with that or not. So maybe just starting everyone on a level playing field with some more information about how that can go … maybe just having a little more support [for example, including articles, or a dedicated webpage about representation among women of color] if people do need help.*
- *I think that we have been finding that activities that have a cultural focus – and we've worked particularly with native communities and have developed activities making science and making activities with [them] that have a cultural focus – but we're finding that students, both native and non-native, are engaging in those activities a lot longer than they do in other activities that don't have a cultural focus. I think that's really interesting, and these are also really preliminary findings, and the research is not complete, but that was really interesting for me to think about when we think about doing an activity and sharing about culture, it needs to be culturally responsive and appropriate and created with partners, [that's] a big thing. But it seems that all students engage in it and are excited to learn.*
- *I think letting them know that there's a wealth of experience there to connect them to their activity at hand … maybe with [the wetlands activity] you talk about a country that you've heard of or you've been to or that your parents are from, instead of just looking at all of the toads from the US. That's a very interesting and easy way to bring in diversity in ways that, I think as adults in the educational world, we don't always think about … [In terms of other suggestions, working] in small groups, find one thing that unites you, like you all like [a certain musician], and one thing that doesn't, how are you different from this group in one thing, and talk about how those things affect the way you see technology, [for example].*
- *I think some resources for teachers … things we could give the teachers to say, just to give them an idea of how to implement these strategies [would be helpful]… not lesson plans, but a kind of resource guide the teacher could look at for each strategy.*
- *If there's a list of resources, of places that we can [visit] … free locations … so I'm thinking of maybe some outside connections to places, so girls can have those hands-on experiences … Thinking about [the socioeconomics and the backgrounds of our girls, I know they don't get to leave our area that often, so it would be great to have support in providing more opportunities to help us make that happen].*
- *I would love it if [the resources for parents] could be translated into Swahili.*

Discussion

The overarching goal of the *SciGirls CONNECT² * project 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). During the three-year project period, the research team addressed this question by focusing on the experience of girls participating in the *SciGirls CONNECT²* partner programs.[14] The evaluation team, meanwhile, pursued a parallel effort that considered the experience of the partner educators who implemented these programs, focusing specifically on their use of the *SciGirls Seven* and the draft *SciGirls Strategies*. The evaluation team sought the educators' feedback at key milestones to facilitate TPT's efforts to revisit and update the *SciGirls Seven* and related strategies.

As shown in the flowchart below, educators provided program information and feedback on their use of the original and draft updated strategies at four points over the grant period through a series of online surveys, follow-up interviews, and program reporting. The Phase 3 work, the subject of this report, focused on the partner educators' use of, reflections on, and recommendations relating to the draft updated *SciGirls Strategies* in Year 2 of their *SciGirls CONNECT²* programs.

SciGirls CONNECT² Evaluation
Partner educators' programming and evaluation activities
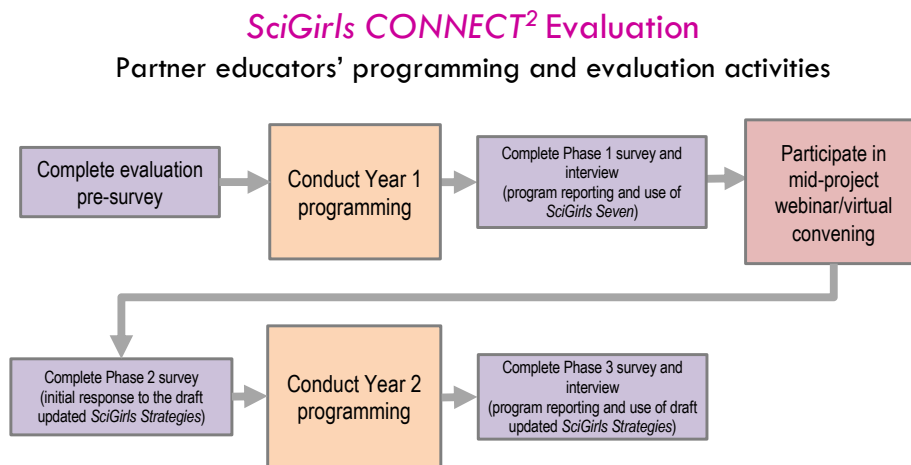
This Discussion considers the educators' feedback about the draft updated *SciGirls Strategies* in four main areas: 1) their perceptions and use of the strategies overall; 2) their perceptions and use of the framework for strategy development; 3) their perceptions and use of the individual strategies; and 4) their anticipated use of the final strategies. Where applicable, the Discussion also presents overarching observations in an effort to help inform the project's efforts to finalize the *SciGirls Strategies*. Although this Discussion primarily focuses on Phase 3 of the formative evaluation, it also incorporates applicable educator feedback from Phase 1 (feedback shared at the end of partners' Year 1 programs, during which educators used the original *SciGirls Seven*).[15]

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[14] Hughes, R., Roberts, K., & Schellinger, J. (2019). SciGirls CONNECT2 Research Report. Unpublished manuscript, Florida State University, Tallahassee, FL.

[15] Knight Williams, Inc. (2018). *SciGirls CONNECT²*: Formative evaluation of educators' use of the *SciGirls Seven* strategies in Year 1.

It is important to note that caution should be taken in drawing broad implications from the findings, given that the evaluation relied on a relatively small sample of 25 educators from 13 partner organizations to provide feedback. Additionally, some of these educators were less familiar with *SciGirls* than others; for example, two-fifths of the educators had a year or less of experience with the *SciGirls Seven* and/or the draft updated *SciGirls Strategies*, largely due to staff turnover and the inclusion of two new partner organizations in Year 2 of the project. However, the evaluation team found that educators with all levels of experience provided in-depth feedback about their use of the strategies in their programs.

Although seven of the 13 partner organizations did not meet at least one of the *SciGirls CONNECT²* program requirements (details of which are provided in the Background section of this report), the opinion of the evaluation team is that this did not substantially affect educators' abilities to provide feedback on their use of the draft *SciGirls Strategies*. For example, although some partners failed to meet the minimum number of program hours and girls (16 hours and 10 girls ages eight to 13, respectively), all but one of the partners had at least 10 hours of *SciGirls* programming, and they all had at least eight girls in this age range. Additionally, three partners did not host a family event or incorporate youth-created videos; however, these program requirements weren't directly tied to the draft *SciGirls Strategies*. Finally, although three partners did not quite meet one program requirement that *was* directly tied to a strategy (to include at least three female role models/STEM professionals), this was an area where some educators noted they had fallen short and provided feedback on the specific challenges they faced, as detailed in the section below looking at educators' perceptions and use of the individual strategies.

Educators' perceptions and use of the *SciGirls Strategies* overall

Response to the SciGirls Strategies as a whole
Overall, the *SciGirls CONNECT²* educators liked the *SciGirls Strategies* and felt they met their expectations. As a reference resource, they perceived the strategies to be well organized, cohesive, clear/easy to follow, and easy to use. The educators also generally thought the strategies were *very effective* in impacting the four main areas that TPT envisioned, specifically: facilitating girls' STEM identity, engaging girls from diverse racial/ethnic and socioeconomic backgrounds in a culturally responsive way, helping educators address teaching challenges, and helping them reflect on or modify their own teaching practices. Overall, the educators also reflected that it had been easy for them to shift their thinking from the mindset of the original *SciGirls Seven*. Looking ahead, they anticipated they would use the strategies in their next informal STEM program for girls and would recommend the strategies to other educators.

How the SciGirls Strategies were considered in planning/implementation
The educators approached the strategies in different ways when it came to planning and implementing their programs. The largest group, two-fifths of the educators, indicated that they had prioritized one or more strategies consistently. A third said they used the strategies synergistically or as a set, and one-quarter said they used different strategies in different

situations. Among the 15 educators who commented on whether their approach was similar to or different from how they previously used the *SciGirls Seven*, all but two thought they had previously considered the *SciGirls Seven* in a similar manner.[16] One was not sure, and one explained that she had used a different approach, as in, "*We used to think of [the strategies] more holistically, but we've kind of moved away from that in planning our lessons … [Now we are prioritizing one or more strategies consistently because] we're trying to make it more individualized for the girls. If we can focus on one or two or three of the strategies at a time, we can hopefully go deeper with that than trying to hit all of them*."

Given that there was some discrepancy in how educators considered the draft updated *SciGirls Strategies* in planning and implementing their programs, if TPT prefers educators adopt one of these three approaches over the others, it may be important to highlight the preferred approach when presenting the final version of the *SciGirls Strategies*. Alternatively, if these three approaches (or any other approaches) are deemed equally desirable, it may be worth informing educators about the virtues of this flexibility and offering them examples of the different ways they might use the strategies in planning and implementing their programs.

Materials that facilitated use of the SciGirls Strategies

While the partner educators did not receive a full training on the draft updated strategies, they were provided with a set of five preparatory materials to facilitate their use. These included: the *SciGirls Strategies* and Tips document, the *SciGirls Strategies* references document, the hour-long webinar introducing the strategies, the hour-long webinar/office hours session, and the chart showing the relationship between the original and draft strategies, shown in Image 4.

Image 4: Slide from the March 2018 webinar detailing the similarities and differences between the *SciGirls Seven* (on the left) and the draft *SciGirls Strategies* (on the right)

In general, educators who used each of these five materials found them *very valuable*. However, a few educators felt that the materials did not fully meet their needs, as in, "*To be honest, I read the resources and then forget about them during the course of the program. I think I have a decent understanding of the goals and strategies and then just let the program run organically without checking back on the documents.*"

Additionally, educators used some materials more than others. While nine-tenths each indicated they reviewed the *SciGirls Strategies and Tips* document and the chart showing the

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[16] In comparison with the feedback presented in the *SciGirls CONNECT²* Phase 1 evaluation, this appears to have largely been the case. Among the 20 educators who commented on how they used the original *SciGirls Seven* in their Year 1 programs, half said they prioritized one or more strategies consistently, one-third used the strategies synergistically or as a set, and one-fifth used different strategies in different situations (Knight Williams, Inc., 2018).

relationship between the original and draft strategies, less than four-fifths each watched the webinar introducing the strategies and reviewed the references document, and two-fifths attended (or later viewed) the webinar/office hours.

Overall, the educators seemed to appreciate the range of preparatory materials available, although some mentioned a desire to receive a full training and/or the *SciGirls Strategies* complete guide. Additionally, a few explained that – in the future – they would appreciate a summarized version of the final strategies, as in: "*I love how much [information they've provided] in terms of research, but I think some of that needs to be toned down a little bit in the final resources. [They need something] where people can glean the strategies and not get lost in the research.*"

As a point of comparison on this issue, the *SciGirls CONNECT²* Phase 1 evaluation found that educators tended to use three primary sources to facilitate their work with the original *SciGirls Seven*: the *SciGirls Seven* complete guide (used by three-quarters of the Year 1 educators), the two-page reference (used by nearly two-thirds of the educators), and the postcard (used by two-fifths of the educators) (Knight Williams, Inc., 2018).[17]

Taken together, these findings indicate that educators will likely appreciate the opportunity to both participate in a training and refer to a range of materials on the final *SciGirls Strategies* so they may incorporate those that best fit their particular circumstances and programs.

Most useful resources for implementing the SciGirls Strategies
When asked which *SciGirls* resources they found most useful in implementing the draft updated strategies, the *SciGirls* activities stood out, as this type of resource was mentioned by four-fifths of the educators. Meanwhile, roughly half of the educators pointed to the episodes or episode clips, the women in STEM videos, and/or the CONNECT website, while other resources were cited less often. Given this feedback, TPT's plan to provide guidelines for using the final *SciGirls Strategies* with older *SciGirls* activities is of great importance, as are any connections the team can highlight between the updated strategies and existing media resources.

Educators' perceptions and use of the framework for strategy development

The overarching framework for strategy development is described in TPT's *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**

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[17] The Year 1 partner organizations were selected for *SciGirls CONNECT²* in part because of their familiarity and experience with the *SciGirls Seven*. For this reason, the Year 1 educators did not receive training or view webinars about the original strategies at the beginning of the project, and trainings and webinars about the strategies were not included in partner feedback about sources that facilitated their use of the *SciGirls Seven*.

> **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 aspects of the framework highlighted in bold, in each case the evaluation sought educators' feedback with respect to clarity and ease of incorporating that aspect into their use of the strategies. In general, the educators found each aspect to be *very clear* and *moderately easy* to incorporate**,** although in each case some educators commented on implementation challenges or concerns, as outlined below.

Consider the learning environment
Overall, educators indicated that they found this aspect of the framework *very clear* and *moderately easy* for them to consider throughout their use of the draft updated strategies. Some educators shared examples of how they tried to create an inclusive learning environment in their programs, shared in Appendix 2. A few described challenges they experienced in creating an inclusive learning environment, such as: fluctuating attendance, lack of knowledge about the girls in their program, program space limitations, and difficulties "*[customizing] the learning environment … for a diverse group*."

Utilize culturally responsive teaching practices
Overall, educators indicated that they found this aspect of the framework *very clear* and *moderately easy* for them to consider throughout their use of the draft updated strategies. However, throughout their surveys and interviews, the educators consistently requested additional guidance from TPT on how to become a culturally responsive educator, specifically in the form of trainings, written materials, and/or videos. A few educators also expressed concern that they (or others) would *incorrectly* incorporate culturally responsive teaching strategies, indicating that further support in this area would be important for increasing educators' knowledge as well as their personal comfort and competence (as in, "*For me, culturally responsive teaching is something that I have not had a lot of training on and still have a lot of questions about … I don't want to do it wrong*" and "*Maybe [TPT should provide] examples of things to say, that are generic enough that people can pull that little piece of it and plug it into the situation that they're having … because I think people are going to have a harder time with [cultural responsiveness] and/or they're going to be sensitive to it and they're going to want to make sure they're saying the right things, so they're not going to be a risk-taker in trying out different statements, so I think offering examples … would give people comfort for that*").

As further context, note that in their qualitative comparative case study of three partner sites, the *SciGirls CONNECT[2]* project researchers did not see evidence of culturally responsive teaching strategies in the partner programs, and similarly observed that "*educators did not fully understand [culturally responsive teaching] and how to use the construct*" (Hughes et al., 2019, p. 3). These findings further highlight the need for culturally responsive trainings and materials for educators.

Finally, throughout their evaluation feedback a few educators suggested specific topics TPT might include in future culturally responsive trainings and materials, including: "*racial biases or power imbalances*," "*race and intersectionality*," and "*behavior management or social-*

emotional learning." Some educators also shared suggestions for how TPT might (better) incorporate cultural responsiveness throughout the strategies and/or the framework for strategy development. For example, more than a quarter said they thought the strategies and/or framework should emphasize the importance of listening to and connecting with youth and families. One of these educators observed that doing so would help educators to check their own biases, but this same educator also suggested the need for additional support and guidance on how to self-reflect on personal bias, explaining, "*[You need to think] about your own biases and what values you hold dear and [try] to step out of yourself and out of that perspective and into someone else's shoes … but I don't know exactly how to do that, aside from getting to know each girl better and learn about their families.*" Finally, a few educators requested examples or tips for incorporating cultural responsiveness into their teaching, as in, "*It would be helpful to have examples of ways to be inclusive in a group way, [as opposed to an individual girls' way], without making people feel grouped*)."

Focus on girls' STEM identity
Overall, educators indicated that they found the framework's focus on STEM identity *very clear* and *moderately easy* for them to keep top of mind throughout their use of the updated strategies. However, as discussed below, only about half of the educators pointed to STEM identity when asked to identify the goal of the strategies. Similarly, only about half of the educators reflected that the strategies impacted their girl participants in all three of the areas that contribute to STEM identity (girls' STEM interest, self-confidence, *and* motivation, as defined by the project).

<u>*Whether fostering girls' STEM identity was viewed as a goal of the SciGirls Strategies*</u>
When asked what they perceived to be the overall goal(s) of the draft *SciGirls Strategies*, about half of the educators cited more than one goal. Half identified the goal of fostering girls' STEM identity, either by mentioning STEM identity directly or referencing it sufficiently, as in, "*I felt like the overall goal of the strategies was to … have the girls really see how [STEM] fits into their lives and their future.*" Looking specifically at the three aspects of STEM identity drawn from the project's definition (*STEM identity integrates confidence, interest and motivation around STEM, and ultimately affects choices, behaviors, persistence, and perceptions of STEM careers and STEM professionals*), about two-fifths of the educators pointed to the goal of increasing girls' STEM interest or engagement, one-fifth mentioned increasing girls' STEM confidence, and none of the educators mentioned increasing girls' motivation in STEM.

At the same time, fostering girls' STEM identity wasn't the only goal identified by the educators. About one-quarter thought the goal was to showcase diversity in STEM, while smaller groups thought the goal was to foster independent/individual thinking, or gave another response. As the range of responses shared above point to some level of confusion among educators about the overall goal of the *SciGirls Strategies*, it will be important to clearly state the goal of the updated strategies, keeping in mind that many *SciGirls* educators are accustomed to using the original *SciGirls Seven* with the (distinct and more focused) goal of engaging girls in STEM.

As a point of comparison, note that after their Year 1 *SciGirls CONNECT²* programs, nearly three-quarters of educators <u>were</u> able to identify the goal of the original *SciGirls Seven* as engaging girls in STEM (Knight Williams, Inc., 2018). This could be due, in part, to how clearly

this goal was presented in the complete guide (the cover of which is shown in Image 5) and other *SciGirls Seven* materials and trainings. With this in mind, the project team may want to consider adding a tagline like "*How to foster girls' STEM identity*" to the materials they intend to share when they present the final version of the updated strategies.

As suggested in the *SciGirls CONNECT²* Phase 1 Report, conveying the goal of the *SciGirls Strategies* to educators who are newer to the strategies may prove a somewhat less complicated, or at least a conceptually different task, than communicating the shift in goal emphasis from STEM engagement to STEM identity to those who have been

Image 5: Cover of the *SciGirls Seven* complete guide

working with the *SciGirls Seven* for years (Knight Williams, Inc., 2018). While the educators in the current evaluation agreed, overall, that it was easy to shift from the mindset of the original *SciGirls Seven*, a few educators disagreed and elaborated on challenges they encountered, as in: "*I thought that the biggest challenge for me was getting my head out of the [old] strategies and into the new ones. The old strategies were short and concise and easy to remember for me, but the new ones are multi-faceted in a way which makes them harder to remember and more confusing for me to use and think about all the time, I have to keep referencing the sheet, BUT I do like the new strategies and I think that they're important, but they're harder for me to remember.*"
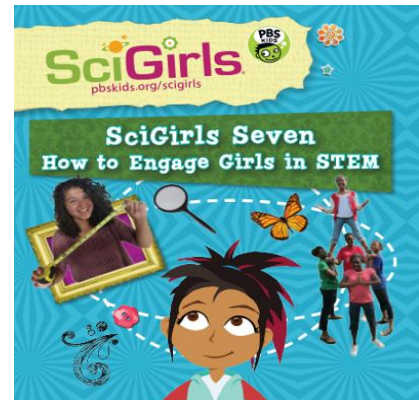
While prior familiarity with the *SciGirls Seven* could affect educators' receptivity to and comprehension of the goal of the *SciGirls Strategies* in a number of different ways, the evaluation findings nonetheless suggest the need for future *SciGirls Strategies* trainings and materials to factor in educators' prior experience with the *SciGirls Seven* and/or the draft *SciGirls Strategies*. It seems reasonable to expect that educators' experience will vary considerably, just as in the current evaluation where the two largest groups of educators were divided between those who had a year or less of experience with the strategies (in their original or draft updated form) and those who had five to eight years of experience.

Finally, in addition to clearly conveying the updated goal of the final *SciGirls Strategies*, it will also be important to outline for educators what is meant by "fostering girls' STEM identity," whether by highlighting the three aspects drawn from the project's definition (specifically, girls' STEM interest, self-confidence, and motivation) or by using another description, such as the following definition from the *SciGirls Strategies and Tips* document in Appendix 1: "*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.*"

Here again, in communicating the updated goal to educators through trainings and support materials, it will be important to take into consideration their prior experience not just with *SciGirls*, but also with facilitating girls' STEM identity. It seems reasonable to expect a considerable range of experience in this area as well. Although the current evaluation did not specifically ask educators about their background in facilitating girls' STEM identity, largely due to the complex nature of the ask and the need to inform educators of the project's

definition, the evaluation did ask educators about their experience engaging girls in STEM. As with the strategies, there were two major groups, as about half of the educators had five or more years of experience engaging girls in STEM, while half had less than five.

Whether educators thought the SciGirls Strategies facilitated changes in girls' STEM interest, self-confidence, and motivation
Looking at STEM identity through the lens of the project's definition (shared in the previous section), the evaluation asked educators if they thought the draft *SciGirls Strategies* facilitated changes in girls' STEM interest, self-confidence, and motivation.[18] Nine-tenths of the educators identified changes in girls' interest in STEM, while smaller groups – but still the majority in each case – thought the strategies facilitated other changes. Four-fifths pointed to girls' self-confidence in STEM, two-thirds to girls' motivation around STEM, and just under half said they thought the strategies facilitated changes in all three areas (girls' STEM interest, self-confidence, *and* motivation), which together contribute to STEM identity, as defined by the project.

Although the evaluation was not designed to investigate if and how the application of each strategy (or the intersections of strategies, as described in the project research report) influences the various aspects of girls' STEM identity development[19], in general, the evaluation did find that educators who had observed changes in girls' STEM interest, self-confidence, and/or motivation pointed to some strategies more than others. Strategies #2, #3, #5 and #6 were most frequently mentioned, while Strategies #1 and #4 were cited less frequently or not at all. Specifically:

‣ In terms of facilitating **changes in girls' interest in STEM**, the largest groups who shared a response (n=20) pointed to Strategy #6, mentioned by half the group, and Strategy #2, mentioned by just under one-third. Strategies #1, #3, and #5 were each cited by a fifth of the educators, and none of the educators thought Strategy #4 was most important in facilitating changes in girls' interest in STEM.

‣ In terms of facilitating **changes in girls' self-confidence in STEM**, the largest groups who shared a response (n=15) pointed to Strategy #3 and Strategy #5, both mentioned by about half the group, with the other four strategies being cited by small groups of about one-tenth each.

‣ In terms of facilitating **changes in girls' motivation around STEM**, the largest groups who shared a response (n=14) again pointed to Strategy #5 and Strategy #3, both mentioned by approximately one-third of the group. About one-fifth each pointed to Strategies #1, #2, and #6, while a small group of less than one-tenth cited Strategy #4.

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[18] The quantitative portion of the *SciGirls CONNECT²* research study, meanwhile, focused on changes from pre to post for 148 youth in fourth through ninth grade, using scales for STEM Identity (and subscales of Self-Perception and External Perception) and STEM Self-Efficacy (and subscales of Self Confidence, Openness to Challenge, and Willingness to Learn) (Hughes et al., 2019).
[19] Given that the three sites observed in the *SciGirls CONNECT²* research study used different strategies more frequently than others, the authors concluded that additional research in this area was needed and that "*An observation rubric to highlight when and how often each strategy is used would be a useful tool for future research on the SciGirls Strategies*" (Hughes et al., 2019, p. 18).

The Phase 3 evaluation sought educators' feedback on each of the draft updated *SciGirls Strategies* at various points in the formative survey and follow-up interview, which – when combined and looked at by individual strategy – amount to considerable feedback on each strategy's clarity, perceived value, and use, as summarized below.

#1 Connect STEM to girls' lives
Overall, educators found Strategy #1 *extremely clear*, thought it was *extremely valuable* to their programs, and thought they used it to *a great extent*. When invited to share questions or comments about the individual strategies, three-quarters of those who shared a response (n=19) commented on the value or ease of use of the strategy, while one-quarter commented on challenges encountered and/or gave suggestions for how TPT might revise or support their use of Strategy #1, as in: "*We found that this strategy was a little difficult in that we only had a week with the girls so there wasn't a lot of time to get to know the girls' lives individually and we had to make assumptions on girls lives because of this situational circumstance.*"

#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 *extremely clear*, thought it was *extremely valuable* to their programs, and thought they used it to *a great extent*. When invited to share questions or comments about the individual strategies, nine-tenths of those who shared a response (n=17) commented on the value or ease of use of the strategy, while one-tenth noted challenges they encountered and/or gave suggestions for how TPT might revise or support their use of Strategy #2, such as: "*I think something about 'hands-on STEM' needs to be in this descriptor, like: Provide authentic opportunities through 'hands-on STEM' that mirror the practices of STEM and help girls develop their own ways of exploring and sharing knowledge.*"

#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 *extremely clear*, thought it was *extremely valuable* to their programs, and thought they used it to *a considerable extent*. Additionally, when invited to share questions or comments about the individual strategies, all of the educators who shared a response (n=18) commented on the value or ease of use of the strategy, while one-fifth also commented on challenges they encountered and/or gave suggestions for how TPT might revise or support their use of Strategy #3, including: "*Strategy [#3] is great but not sure all educators apply it. I would like to see lots of good examples provided for educators to use with their girls.*" Notably, the research team also observed in their qualitative comparative case study of three sites that this was among the strategies used least often, along with Strategy #4 (Hughes et al., 2019).

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

Overall, educators found Strategy #4 *extremely clear*, thought it was *very valuable* to their programs, and thought they used it to *a considerable extent*. When invited to share questions or comments about the individual strategies, two-fifths of those who shared a response (n=17) commented on the value or ease of use of the strategy, while two-thirds commented on challenges they encountered and/or gave suggestions for how TPT might revise or support their use of Strategy #4, for example: "*I don't think it's entirely necessary to challenge STEM stereotypes as this may be what the [girl] is striving for. I think what's more important is for girls to be authentic and confident in their 'true selves' as being capable of whatever they work towards.*" Additionally, the majority of educators who commented on strategies they had used to *a considerable extent* or less commented specifically on Strategy #4, further indicating that some educators found this strategy somewhat more difficult to incorporate. Notably, the research team also observed in their qualitative comparative case study of three sites that this was among the strategies used least often, along with Strategy #3 (Hughes et al., 2019).

Looking across educators' evaluation survey and interview feedback, Strategy #4 generated the largest number of comments, suggestions, and questions. Some explained that they had trouble understanding "*HOW to actually [use this strategy]*" and/or requested examples of the strategy in use. Meanwhile, others identified aspects of the strategy that they found difficult to implement, in some cases due to girls' young ages, their unfamiliarity with STEM stereotypes, and/or educators' desire to highlight some of the "*positive stereotypes of women in STEM.*" At the same time, a few educators expressed confusion about the meaning of "true selves" in the language of the strategy, as in, "*I'm not 100% sure what that means. True selves in the sense of their identity or personality or both?*" However, a few others suggested rewording the strategy to focus <u>more</u> on girls' true selves, as in, "*The part of that strategy I really loved is 'bring their true selves' – no matter what that is, if you want to be the stereotype or if you want to do something different, just been authentic and be confident in what you want to do and in your abilities.*"

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

Overall, educators found Strategy #5 *extremely clear*, thought it was *extremely valuable* to their programs, and thought they used it to *a great extent*. When invited to share questions or comments about the individual strategies, more than nine-tenths of the educators who shared a response (n=16) commented on the value or ease of incorporating the strategy, while one-fifth commented on challenges they encountered and/or gave suggestions for how TPT might revise or support their use of Strategy #5, such as: "*I do agree that generally in whatever field or career one chooses there is value in being able to work together cooperatively as a team but also letting SciGirls know that sometimes you work alone in a lab is ok too.*"

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

Overall, educators found Strategy #6 *extremely clear*, thought it was *extremely valuable* to their programs, and thought they used it to *a great extent*. When invited to share questions or comments about the individual strategies, nine-tenths of those who shared a response (n=18) commented on the value or ease of use of the strategy, while less than one-fifth commented on

challenges they encountered and/or gave suggestions for how TPT might revise or support their use of Strategy #6, such as: "*We could have done better here. The two role models were white women*" and "*[They might add] that the role models live in your area.*" Additionally, throughout their surveys and interviews some of the educators explained that they had trouble finding STEM professionals who: came from diverse backgrounds, represented a range of STEM fields, and/or hadn't previously had an in-person visit with their girls. Finally, the majority of educators who commented on strategies they had used to *a great extent* pointed to Strategy #6, potentially highlighting an enthusiasm for incorporating diverse STEM professionals into their programs, in spite of the challenges some partners encountered in this area.

Educators' anticipated use of the final *SciGirls Strategies*

This final section considers educators' feedback about how TPT might support their use of the final *SciGirls Strategies*, as well as barriers or challenges they thought they might face.

Suggested support for using the final SciGirls Strategies
When asked if there was anything TPT might do or provide in order to help them feel more prepared to implement the final version of the *SciGirls Strategies*, three-quarters of the educators suggested TPT provide or add to specific resources, for example making graphics for each strategy or tip that could be shared on social media, providing benchmarks for future *SciGirls* programs, and creating printed and online guides aligned to the updated strategies. Two-fifths each requested trainings and/or examples of or tips for using the strategies. Smaller groups of roughly one-tenth each said they thought it would be helpful if TPT would facilitate educator connections, help their programs connect with STEM professionals, or gave other suggestions.

Anticipated barriers or challenges in using the final SciGirls Strategies
When asked if they expected to face any barriers or challenges in their use of the final version of the *SciGirls Strategies*, no one issue stood out to educators. More than half of the educations didn't answer the question or indicated they had no concerns. About a fifth each shared implementation challenges they experienced during their programs and/or thought they might experience challenges using the strategies with other youth, for example, mixed-gender groups, different ages, and different levels of experience with STEM. One educator explained that even though it might be harder to use the *SciGirls Strategies* with a different group of youth in the future, she thought the strategies and framework would provide the support she needed, saying, "*I think these strategies will work with our other audiences who are much less interested in STEM [than the girls in our program were], but we will have to work harder and be more deliberate about our approach and adapting it along the way. (Which is when the strategies and framework will probably be even more useful!)*"

Additionally (and as noted earlier in this Discussion), elsewhere in their feedback some of the educators indicated that they found the transition to the draft updated strategies somewhat challenging due to their familiarity with the original *SciGirls Seven*, as in: "*It was difficult for me*

sometime to shift my thinking to the updated strategies, I think because I was so familiar with the original strategies."

Taken together, these findings indicate that when the *SciGirls Strategies* are finalized and shared more widely, the project team may want to follow educators' suggestions by both emphasizing the familiar aspects of the updated strategies (as done in the March 2018 webinar presenting the draft updated strategies, shown in Image 4 on page 54), and by highlighting the added value of the updated strategies, particularly in reference to fostering girls' STEM identity. As one educator explained, "*Going back to that building of a STEM identity, these new strategies have made me think … how is the work we're doing promoting a STEM identity in the students that we're working with? I think it just made me think more about all the practices I use to engage students and how it contributes to that identification in STEM.*"

Appendix 1:
SciGirls Strategies and Tips and references

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 <u>reflection questions</u>.

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. <u>Click here</u> 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, Peppler, & 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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Appendix 2: A compilation of educators' tips for using the *SciGirls Strategies*

Knight Williams, Inc.
Shared with TPT February 2019

#1 Connect STEM experiences to girls' lives

- *[In terms of tips I would add], the one thing that I did … was asking purposeful questions … I use that technique a lot … [and it can tie in to a lot of these strategies and can be used to relate STEM] to their lives … and help them gain more understanding of whatever you're doing.*
- *Just think about pop culture, a lot of the music they like [and] movies they watch … find out how to connect STEM to their interests. [For example] makeup came up one time, so we talked about how much money makeup brought in a year [and we talked about] scientists and chemists, [the part] you don't get to see in the commercials.*
- *[In terms of] Strategy #1, I think we … did a good job of trying to connect them to the future of their lives … trying to connect them with a future perspective … but we took it very literally [and didn't really ask the girls about their own experiences in this manner], except perhaps calling their knowledge out … I think you could cover this in a day or in half a day, as long as there's a running line between those activities … [but we didn't really connect one activity to the next to the next, which would have allowed the girls to make those personal experiences in that manner, so] I feel like we almost delivered a vignette of STEM, versus a narrative of STEM that connected them to their past experiences, and their future, and their current [selves] … [Not having experience in an area could be marginalizing], but creating an easy way for them to have a connection to one of their experiences [in an earlier program activity] may enhance their experience and their willingness to go further in that activity.*

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

- *I think some of the biggest things were allowing girls to explore their own interests. We used different interactive mobile development apps … allowing them to explore a bit on their own.*

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

- *At the end of each day's lesson, we showed pictures of your typical science career for that particular topic, whether it be biology or chemistry or physics, but then we expanded that to show that you can still be involved in this field through other [ways], so when we talked about geology we talked about if you're interested in gemstones or crystals or jewelry, that's the way you're still learning about that topic, but you're not necessarily a geologist. So in that way we were kind of expanding on the stereotypes … like, "You might think these are the only career options that exist for this particular topic, but look at all of these other options!" … I think it's important to note where the limitations are and push past them.*
- *Under #4, in the tips, I like what they're saying here, but maybe having another tip or suggestion, maybe the girls either in their journals or in the classroom, they could create a bulletin board [with women they've researched] who are pertinent to the work they're doing or inspirational. [There's also a great resource TPT might tell others about – it's a book with drawings of women, as opposed to photos, which I think makes it easier for girls to connect … it's called Women in Science: 50 Fearless Pioneers Who Changed the World.]*

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

- *We would have them choose their group in the morning, and in the afternoon we would assign them a group.*
- *Unless your kids are coming specifically just for SciGirls, you have a lot of things that you have to get in in the short time they're [part of your afterschool program], so thinking ahead and … being intentional about how you do that, and mixing up the group [partnering the new girls with the girls who had some experience with SciGirls], that was a nice mix in the dynamics of the group.*

#6 Provide opportunities for girls to interact with and learn from diverse STEM role models
- *One way that we were easily able to bring diversity was through a very diverse role model panel group.*
- *Something that we've started to do … in the individual [mentor] conversations, [is] have the girls ask the mentor something that relates to their lives … An example of this [was when we had someone come in who works for the Department of Transportation.] We preload the information, so we have the girls, that day before, learn more about the mentor [and] do their own investigation into what they think she does, what her background is, and develop some questions that they may have for her. And one of the girls was like, "There is a bus stop on my street that has very little resources, and there was actually a traffic accident last year where a student died, what can I do to help my community not have that happen again?" So I love that the focus is on the individual, knowing that they all come from these different places, and having them focus on what does that mean to them through all of these lessons and resources and people they're interacting with.*
- *[With our role model time], we used to do that as a [group, with all ages] … [and now we've decided] to do it in smaller groups because it gives the girls more opportunity to ask individualized questions of her. And then also we instituted these reflection pages where they have more guiding questions for the girls to reflect on, a question they may ask the role model and what that means to them, and then we collected those over time so that the girls could walk away with all of their reflections, instead of being so one-off-based. [We want our curriculum] to ask more of the girls [about why this matters] in their lives. So we've done a lot of journaling, we've done a lot of out loud/talking, but putting that to paper, and also finding issues they really care about and bringing those to the table, I think have been really important for us to focus on.*
- *We really tried to find more diverse [role models to visit the girls, and once a week we also presented a PowerPoint about] someone who couldn't come to us in person, but [who] was known nation-wide or world-wide, from a diverse background as well.*
- *[It would also be helpful to have accompanying bios for each of the diverse Mentor Moments], showing where they went to college, what did they study, what are their interests, maybe inventions or things that they've worked on. Something like that would be very helpful when implementing Strategy #6, when trying to introduce girls to more diverse role models, to just have a profile on that scientist that we could pull up and look at … it could be on a one-page document with a picture of the STEM Mentor and then her college and degrees (which promotes girls thinking about which colleges they might want to attend), where they work or have worked, interesting facts (to help the girls make personal connections with them; i.e. favorite color, hobbies, foods etc.), who inspired them or how did they work through challenges (growth mindset) when earning their degree or in their profession, and then a link to a video (mentor moment from a SciGirls episode or one of them at work) so the girls can see a snapshot into what they do on the daily at work.)*
- *For #6, because [we found it challenging] to recruit diverse role models … I tried to invite [the girls'] parents and talk about it with their parents, and [most of them didn't work in STEM], but … we were able to talk about people they knew in their home countries that were in STEM fields or were related to that, to help [the girls] picture and realize [the opportunities available to them.]*
- *I had two interns, two college students … and it was good for the girls to see the interns lead activities and share life experiences and talk about career goals, because they were two young, passionate women – so it was about [my] taking a backseat and allowing the girls to interact with the interns, to be inspired by them. [It allowed us to incorporate the role model strategy into our program in another way.]*
- *One of the girls specifically asked if we could have some male mentors as well. The wanted to see even more diversity.*

STEM identity
- *Though we got to know the girls all pretty well, I think for next time it would be useful to review the pre-surveys a little more in depth to really understand where the girls are starting in their STEM identity. Or maybe even facilitating a discussion about STEM identity as a group and what that means.*

Culturally responsive teaching strategies
- *[With the invasive species activity, we had girls research online] about invasive species and environments that they were not familiar with … because of where we are, they don't have that exposure to go outside [and visit a local pond] … when we think about our students and their socioeconomics, what they're exposed to and where their families are from, [some girls were born in Africa and then came here] and those are the only two places they're familiar with.*
- *… maybe with [the wetlands activity] you talk about a country that you've heard of or you've been to or that your parents are from, instead of just looking at all of the toads from the US. That's a very interesting and easy*

*way to bring in diversity in ways that, I think as adults in the educational world, we don't always think about …
[In terms of other suggestions, working] in small groups, find one thing that unites you, like you all like [a
certain musician], and one thing that doesn't, how are you different from this group in one thing, and talk about
how those things affect the way you see technology, [for example].*

The learning environment

- *[The thing we tried to do with everything was] to try to make it relevant, make it make sense … so I think by
setting up that safe space in the beginning … basically having the girls bring in two items that were special to
them, it could have been a picture or an instrument or whatever … and they made kind of a little shrine, a nice
little area that represented them, and so we could look at that and see what their interests were, [and they
could see if they had things in common with the other girls] to make those connections … and then we tried to
incorporate that into what we were talking about throughout the week … and knowing what the girls were into,
we were able to make it more customized and personalized. [Last year and this year we also had a ball with
questions on it that we used to get to know the girls and have them learn about each other], but I think also
having them make a space that felt like theirs – and that's also where they did their Flipgrid videos – I think it
came together really nicely.*
- *We did have the girls bring in two special items that represent them or are meaningful to them, but next time I'd
like to include a portion of time for the girls to explain to the group why they brought the items they chose.
Though the girls made an area to film their Flipgrid videos using their special items and all the girls were able
to view the items, I think allowing time to discuss the girls' interests as a group would have brought greater
understanding of their background to us and their peers.*
- *One of the things that I found in this specific session that we did … is that we changed up the way we used the
space we were in, so in some cases the desks were all separate, and other times we would pull them together in
different groups, and one day we did a conference table, with everyone equally contributing to a discussion …
and I thought "This is a format I'm going to use more" because this is something they responded to and made
them feel equally important to everyone who was there. They weren't being talked down to in any way, they
were part of … everyone in the group, professionals and students, spoke and exchanged ideas equally. After the
event one of the girls told me it was her favorite session. She felt so professional.*