SciGirls Code

Summative Evaluation Report
August 2016 to July 2018

PREPARED FOR

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Twin Cities Public Television
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Executive Summary

SciGirls Code: Connected Learning for Middle School Girls in Out-of-School Time was a 2.5 year NSF STEM+C funded project awarded to Twin Cities Public Television, with National Girls Collaborative Project and University of Minnesota Learning technologies Media Lab. SciGirls Code aimed to spark and strengthen girls’ interest, skills, and confidence as technology creators, inspiring them to pursue education and career opportunities in computer science (CS). The project developed a nine-month curriculum with three strands. The project used principles of connected learning with 16 partner sites to provide 160 girls, and their 32 leaders and STEM role models with computational thinking and coding skills as well as best practices for engaging girls in gender equitable STEM education. Finally, the project aimed to contribute to the field by researching the connected learning model for out-of-school learning of CS.

The SciGirls Code evaluation was conducted by Education Development Center. The evaluation focused mainly on the experience and outcomes of the educators, and the implementation of the program, including the role model experience, at the 16 sites. Evaluation activities included:

- Educator post-training and post-webinar surveys, three post-strand surveys and a Reflection survey;
- Fall/winter interviews with a sample of educators;
- Spring site visits with a program observation and interviews with educators and girls (sample of sites);
- Role models post-training survey and reflection survey;
- Interviews with project leadership (annually); and
- Review and statistics from project documents and online resources, including web stats, attendance data, webinar registration data, and Flipgrid metrics.

Evaluation Findings

- The educators were positively impacted by their experience in SciGirls Code. Educators learned about computer science, how to facilitate the curricular strands, and how to build girls’ computational thinking skills.
  - There were significant increases in educator’s ratings of their knowledge of computer science, their perception of the usefulness of CS to solve problems in the world and make a meaningful difference in people’s lives, and their knowledge of other CS resources and programs.
  - All educators indicated that their ability to show girls how computer science is relevant to their lives, their comfort leading youth in computer science-related activities, and their ability to help youth develop critical thinking or problem solving skills were Medium, High, or Very High (on a 5-point scale) after leading SciGirls Code.
• The in-person training was especially valuable to prepare educators to facilitate the program. While monthly webinars were useful and informative, more ongoing support on the activities and more opportunities to connect with other educators were suggested.

  o The in-person training featured hands-on activities and opportunities to work together with other educators. By the end of the training, educators felt very knowledgeable and prepared to implement most aspects of the project.
  o A large majority of educators “Agreed” and “Strongly Agreed” that the monthly webinars were helpful for their role in the project. However, attendance at webinars declined throughout the year.
  o Preparedness and comfort with the technology for the final strand, E-textiles, was lower than in other strands. This was due in part because it was not well covered during the in-person training which was held about nine months before sites would start the strand.

• Educators used effective practices for engaging girls in STEM, as evidenced in site visits, their own reports, and participant data.

  o Educators made significant gains in their knowledge of strategies to engage girls in computer science, based on a pre-post comparison of their survey responses at the beginning and end of the program.
  o Educators were especially likely to use positive feedback on effort and behavior, opportunities for collaborative learning, hands-on projects and encouraging independent and creative thinking.
  o Ninety-five percent of participants agreed or strongly agreed that their instructor(s) were positive and encouraging during SciGirls Code.

• The SciGirls Code curriculum strands were rated highly for their organization and relevance to the girls, though there were some difficult aspects and technical challenges.

  o At least 95% of educators agreed or strongly agreed that each strand of the curriculum was well organized and at least 88% agreed or strongly agreed that each strand was relevant to the girls.
  o Arduino software, in the E-textiles strand, was considered “too advanced” for their girls by many educators and many educators had technical difficulties with the Robotics Hummingbird platform.

• Many educators needed more time than their program meeting schedule allowed to get through the curriculum activities and strands. They adapted by cutting or shortening activities and/or by skipping role model visits or the use of Flipgrid.
Some educators needed a lot of time to prepare for their SciGirls Code sessions, getting re-familiar with the curricular activities and troubleshooting any technology issues. Having a go-to person, such as a more-experienced educator, to direct their questions would have been helpful.

- All sites successfully completed most parts of the program, holding program sessions until the end of their school year and making it through most of the curriculum.

  - The program sites reached a total of 202 girls (who attended at least 1 session), with an average attendance of 8.6 girls at each session. The range of participants in a program was from five to 23 girls, with a range of attendance patterns at any site. Typically, there was a decline in the number of girls at a session over the course of the year.
  - Programs met for, on average, 92 hours, with a range from 54 hours to 112 hours in total, per program.
  - Two sites never used Flipgrid for Connected Learning.

- The Connected Learning aspect was generally popular among educators and girls and they appreciated how Flipgrid videos allowed them to share their work and ideas over videos. However, not all educators were equally supportive of Flipgrid as a tool for Connected Learning.

  - Educators noted that girls liked to show off their work and see what girls were doing at other sites.
  - At some sites, girls were not interested in connecting with other girls they did not know. Others had issues accessing Flipgrid or girls getting distracted when they were watching the Flipgrid videos.

- The role model component was not consistently implemented at each site, but educators did note the benefits of exposing the girls to female STEM professionals. Data showed role models using effective practices for engaging girls, most frequently making positive connections with girls and using positive messaging.

  - All sites had at least one role model visit during the whole program and six out of 13 sites reported a role model visit during each strand.
  - Educators had difficulties finding and scheduling role models, partly due to their own time constraints and uncertainties about how to best use role models. Role model videos on Flipgrid were a convenient and effective option.
  - A total of 21 role models visited SciGirls Code programs, either in-person or online. They were mostly under age 35 and mostly White/Caucasian.
  - One educator commented, “Whether in real life or from the videos or posters, it was essential our girls saw, met and interacted with successful, collaborative women in the STEM fields.”
The girls felt the role model encouraged them to keep trying in the face of challenges and took time to answer their questions.

The girls were impacted in many ways from their participation (covered in depth in the project’s research component).

As one educator wrote, “The girls learned not only about coding but so many other skills like collaboration, communication, critical thinking, problem solving, debugging, and so much more. The girls have a confidence now that they didn’t have before when they try to do something because out of everything the program promoted perseverance and I saw that in spades towards the end. I know that some of the girls might not be interested in computer science as a career, but they all now have the confidence to try new things and never give up.”

Most partners planned to continue implementing SciGirls Code or parts of SciGirls Code in some mode at their site: “We will absolutely use activities and concepts from SciGirls Code going forward. My organization is trending heavily toward computer science and technology in its STEM program.”

Areas of Recommendation

Recommendations made in the report include allowing programs more flexibility with the timing of programs, such as allowing sites to implement one strand over a shorter-term to accommodate girls who cannot commit to a 9-month program. Additionally, increasing the estimate of time required for each strand would ease the pressure to complete all activities, learn and practice skills, have time for role model visits and Connected Learning activities, and reserve sufficient time for the makeathon.

Integrating role model visits may support more role models visiting girls. Deeper integration of the role model component into the curriculum might look like including a default CS activity that role models could assist with or a suggested structure to facilitate sharing of role models’ stories and interactions.
with girls. Another suggestion is improved integration of Flipgrid for Connected Learning with girls at other sites.

A “help desk,” technical support site, for educators and girls to access for more detailed instructions, videos, tip sheets and troubleshooting on the curriculum, was requested as a first-stop resource for content help and support.

Summary

SciGirls Code was a successful pilot of a new program to increase the capacity of education partners to engage girls in computer science. The project leadership team and the partner sites learned what worked well, such as the in-person training, most of the activities in the curriculum, and experienced challenges that sparked ideas for what to try to do differently in the next project iteration.

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1 Flipgrid was adopted by the project after the training as a replacement for LRNG software.
Table of Contents

Executive Summary ....................................................................................................................................... ii
Evaluation Findings ....................................................................................................................................... ii
Introduction .................................................................................................................................................. 1
Evaluation Overview ..................................................................................................................................... 1
Findings ......................................................................................................................................................... 4

EDUCATORS .......................................................................................................................................... 4
1. What are characteristics of the educators involved? .............................................................................. 4
3. To what extent do educators have what they need from SciGirls Code to successfully implement the program? Are educators comfortable using the technology to implement the program? .................................................................................................................. 13
4. A) How do educators implement SciGirls Code curriculum and activities in their programs (fidelity and adaptations)? .................................................................................................................. 16
4. B) To what degree do educators use effective strategies for engaging girls in computer science (e.g. SciGirls Seven)? ........................................................................................................................... 22
5. How do educator attitudes, interest, confidence and knowledge related to computing change as a result of their participation in SciGirls Code? .............................................................................. 28
6. To what extent are educators aware of the educational and career opportunities in CS and convey them to the girls in their programs? ................................................................................................. 31
7. To what extent do educators understand the nature of computer science and computational thinking and facilitate the development of this knowledge with the girls? ........................................................................... 34
8. What other impacts do educators experience as a result of their participation and training? 36

ROLE MODELS ..................................................................................................................................... 39
1. Who are the role models involved? ........................................................................................................... 39
2. How do role models perceive the effectiveness of the role model training and support? .......... 44
3. What content, activities, and strategies do role models use with the youth participants? How do role models connect with participants (virtually, in-person, lead activities, etc.)? ................. 48
4. To what extent do role models have increased knowledge of how to reach out to girls and increased confidence in their ability to effectively be a role model? ................................................. 52
5. To what extent do role models utilize effective strategies from the training in conducting outreach? ........................................................................................................................................... 52
6. What other impacts do role models experience as a result of their participation and training? 52

YOUTH PARTICIPANTS.......................................................................................................................... 58
7. Who are the girls reached by the trained educators? .............................................................................. 58
9. How are girls affected by role models? How is the impact of role models related to how girls connect or interact with role models? .................................................................................. 63
SCALE-UP ............................................................................................................................................. 69
10. What was learned during implementation of this model that could inform future scale-up? 69
11. What were benefits and barriers of participating for educators and their organizations?.... 70
20. How could the project more effectively and/or efficiently meet its outcomes? ....................... 76
21. What components of the project were most crucial to its success? ............................................ 77
22. To what degree did local adaptations at partner sites affect the success of the project? .......... 79
Areas of Consideration.......................................................................................................................... 82
Summary ..................................................................................................................................................... 84

Appendix A: Logic model
Appendix B: Evaluation Methods and Activities
Appendix C: Metrics on Participation in Training and Support and Use of the SciGirls Code Web Site
Appendix D: Number of Hours Each Participant Spent in a SciGirls Code Program by Site
Appendix E: Summary of the Educators MobileApps Post-Strand Survey
Appendix F: Summary of the Educators Robotics Post-Strand Survey
Appendix G: Summary of the Educators E-textiles Post-Strand Survey
Appendix H: Summary of the Educator Reflection Survey
Appendix I: Summary of the Role Model Post-Training Survey
Appendix J: Summary of the Role Model Reflection Survey
Introduction

In August 2015, Twin Cities Public Television, in partnership with the National Girls Collaborative Project (NGCP) and the University of Minnesota Learning Technologies Media Lab, started implementation of a three-year National Science Foundation (NSF) grant under the STEM + Computer Partnerships Program to use principles of connected learning with 16 committed STEM outreach partners to provide 160 girls and their 32 leaders with computational thinking and coding skills.

The goals of SciGirls Code: Connected Learning for Middle School Girls in Out-of-School Time were to 1) spark and strengthen girls’ interest, skills, and confidence as technology creators before high school, when attitudes and academic choices can influence postsecondary computer science (CS) studies and careers; 2) support girls’ efforts by training educators and role models in best practices for engaging girls in gender equitable STEM education; and 3) contribute to the field by researching the connected learning model for out-of-school learning of CS. SciGirls Code aimed to create new model for using digital media to empower girls, role models, and STEM educators, enriching and supporting girls’ pursuit of CS.

The first year of the project was dedicated to development of a curriculum with three strands (mobile app design and development, robotics, and e-textiles) to engage girls in computer science and build their computational thinking skills. Products of the project include the curriculum, which also included Connected Learning aspects to allow partner sites to learn from each other; a professional development program for STEM educators; role model training for female technology professionals; and a research component focused on girls’ outcomes. A logic model for the program can be found as Appendix A.

Evaluation Overview

Education Development Center (EDC) conducted the evaluation of SciGirls Code. This summative report shares findings from the entirety of the three-year project, with data collected between August 2016-July 2018². An annual report was produced in July 2017 on the data collected to-date, including the educator pre-survey, webinars and in-person training.

The evaluation focused on the implementation of the proposed activities and the progress toward meeting the desired outcomes for the educators, their organizations, the project role models, and the participating girls they reach. A detailed description of the evaluation methodology can be found in Appendix B.

The following evaluation questions were established regarding SciGirls Code implementation and impact and guide all data collection and analysis:

² There was no data collection for the evaluation during the first planning year of the project.
EDUCATORS
1. What are characteristics of the educators involved?
2. What are educators’ experiences with the project training and resources (levels of participation and satisfaction)?
3. To what extent do educators have what they need from SciGirls Code to successfully implement the program? Are educators comfortable using the technology to implement the program?
4. How do educators implement SciGirls Code curriculum and activities in their programs (fidelity and adaptations)? To what degree do educators use effective strategies for engaging girls in CS (e.g. SciGirls Seven)?
5. How do educator attitudes, interest, confidence, and knowledge related to computing change as a result of their participation?
6. To what extent are educators aware of the educational and career opportunities in CS and convey them to the youth in their programs?
7. To what extent do educators understand the nature of CS and computational thinking and facilitate the development of this knowledge with the girls?
8. What other impacts do educators experience as a result of their participation and training?

ROLE MODELS
9. Who are the role models involved?
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15. Who are the girls reached by the trained educators?
17. How are girls affected by role models? How is the impact of role models related to how they connect with or interact with role models?

SCALE-UP
18. What was learned during implementation of this model that could inform future scale-up?
19. What were barriers and benefits of participating for educators and their programs?
20. How could the project more effectively and/or efficiently meet its outcomes?
21. What components of the project were most crucial to its success?
22. To what degree did local adaptations at partner sites affect the success of the project?
Findings

Data are presented in this report in response to each evaluation question.

**EDUCATORS**

1. *What are characteristics of the educators involved?*

**Key Findings**

- Educators were highly experienced; including 61% with more than six years of experience in informal education settings.
- More than half of educators had completed a college course in computer science or coding and 39% had participated in other professional development.
- Before *SciGirls* Code, nine out of ten educators had led basic technology activities with youth and 64% had led computer science or coding activities.
- Fourteen of the 16 partner sites had offered coding or computer science-related programming within the last three years, including Hour of Code, Lego Robotics, geocaching, and coding with SCRATCH.
- Eight of those 14 sites had offered girls-only coding or computer science-related programming.

*SciGirls* Code included 16 partner sites across the U.S., including informal organizations and schools. Partners were identified at the project proposal stage and were all previously involved in other *SciGirls* programming. A pre-survey administered at the start of their engagement in February 2017, with 36 respondents, showed that they had a fair amount of experience as educators in informal and formal settings.

**Prior Experience of Educators**

All respondents at least some experience in informal education settings and 61% had more than six years of experience. Seventy-two percent of respondents had at least some experience in formal education settings. In addition, about three-quarters had been involved in an all-girls environment.

While more than 90% of respondents had led basic technology or digital literacy activities with youth (with a third of all educators having about four years of experience or more), they had comparatively less experience leading computer science or coding activities with youth. Thirty-six percent of educators had never led computer science or coding activities and a 25% of respondents had led computer science or coding for less than a year. A portion of respondents was more experienced leading computer science or coding: 28% had about one to three years of experience and 12% had about four years of experience or more.
In terms of their own educational experiences in computer science or coding, a third of educators had completed high school classes and a little more than half had completed college courses. A handful of educators had received a college degree in computer science or coding. Almost forty-percent of respondents had attended a workshop or professional development in the subject area. A third of respondents had help or lessons from somebody more knowledgeable and a similar percentage indicated they were self-taught.

Project team members commented that successful implementation was not necessarily related to whether educators had done computer science in the past, but whether they had been able and willing to put in time to learn the content and curriculum. Educators were also felt to be more successful when they were willing to be a “guide on the side” that allowed the girls to struggle and learn rather than stepping in to solve their problems.

Perhaps to illustrate this point, a site visit educator declared that nobody with a lower amount of technology knowledge than her should lead SciGirls Code. She spent 2.5 hours on tech support with Hummingbird to get it to communicate with the computers. “I can’t imagine a teacher who didn’t have time to do it.”

Fourteen of the 16 partner sites had offered coding or computer science-related programming within the last three years, including activities of Hour of Code, offering a curriculum for girls, Lego Robotics, computer science in after school or summer programs, geocaching, a coding class, and coding with SCRATCH or Alice. Of those, eight of the sites had girls-only coding or computer science-related programming.
2. What are educators’ experiences with the project training and resources (levels of participation and satisfaction)?

Key Findings

★ Attendance at the monthly support webinar for educators seemed to decrease after the first five sessions, though there are not great records of how the webinar recordings were accessed.

★ The monthly webinars were consistently rated as high quality, with 90% agreeing or strongly agreeing they were high quality for five out of the first six webinars for which a post-survey was administered.

★ Educators generally had a very positive experience at the three-day SciGirls Code in-person training in April 2017 and post-training survey data showed strong gains in their knowledge and comfort in areas related to facilitating a computer science program for girls.

★ Suggestions were made for more ongoing support, including more opportunities, closer to implementation dates, to review curriculum activities (especially for e-textiles) and more technical support.

★ The program web page, with the curriculum, webinar recordings, and other program resources was well-utilized, with over 19,000 page views in 16 months.

★ Educators used Flipgrid mostly as they were planning and starting their programs to build community and learn from each other. There were four topics or prompts for videos from educators with a total of 59 videos posted and 634 views.

Educator participation in online and in-person trainings

SciGirls Code began offering monthly webinars in February 2017, a few months prior to the in-person workshop. Educators could participate in webinars “live” at the time they are offered access the recorded version on the SciGirls Code website. Based on available data, educators’ “live” attendance at webinars was higher at the beginning of the project, though there are limited data regarding how many times recorded webinars were accessed.³

³ Webinar participation was calculated by sign-in of email at “live” webinars and then survey responses where educators selected if they accessed the recording or participated live. Note that the surveys only stayed open for responses for 10 days after a “live” webinar. This method underestimates participation in three ways:
- A group of attendees from a site could login with one email sign-in;
- An educator who accessed the recording within 10 days did not complete a survey;
- An educator accessed the recording more than 10 days after it was offered “live” (when the survey was closed).

“CS is challenging but fun as designed by SciGirls with an integrated approach to include hands-on activities, role model inclusion and group work.”

A SciGirls Code Educator, after attending the in-person training
The monthly webinars focused on a topic that was timely to the current work of many of the educators, including the following topics as the program was gearing up:

- Orientation Webinar (Feb 2017)
- Connected Learning and the SciGirls 7 Webinar (March 2017)
- Computational Thinking, Research & Evaluation Webinar (Apr 2017)
- In-person training (Apr 2017)
- Using Role Models and Recruiting & Retaining Girls Webinar (May 2017)
- LRNG & Supplemental Curriculum Materials (Jun 2017)
- Materials & Digital Meetups (Flipgrid) (Jul 2017)

Webinars shifted to a slightly more open format as educators got more involved with program implementation, with a short presentation or updates by the SciGirls Code team on a timely topic, such as more detailed information on e-textiles activities in February 2018 or tips regarding role models in March. The SciGirls Code team encouraged educators to come with examples of what worked well at their site (such as a lesson learned to overcome a technology challenge or a strategy that worked well to engage their girls) and/or with questions for other educators and reserved time during each webinar for these conversations. When the project team knew of a site that had a success to share or that would be willing to talk through an issue they were having, they pre-arranged it in advance so a site representative would be prepared to present.

**The support webinars at the start of the project were well-attended by educators.**

Educator Attendance at Support Webinars

Starting in Aug 2017, there were no data on who was accessing the webinar recordings

* A post-survey administered after webinars through July 2017 asked if respondents had accessed the webinar recording. The number is an underestimate as it only captured educators who viewed the webinar within two weeks of it being offered and only those who responded to the post-survey. Starting in August 2017, evaluators no longer administered the post-survey and did not track who was accessing the webinar recordings
The web page with the SciGirls Code webinars were most frequently accessed in April 2017 (near the time of the in-person training).

Unique Pageviews of the SciGirls Webinar Page

Available webinar participation data show that five out of 16 partner sites had at least one representative to a minimum of 13 out of 16 educator support webinars. There were two sites that had representation at five or fewer webinars, though as there was limited data regarding access to recorded webinars, their participation is underestimated. For example, one was a school site for which educators may not have been available to attend live sessions. (see Appendix C for more details on participation in webinars).

Experience in webinars

Evaluators administered a post-survey immediately following the first six webinars. After August 2017, educators were asked about the support of SciGirls Code in the post-strand surveys rather than after each individual monthly webinar. Monthly webinars were consistently rated as high quality, with 90% agreeing or strongly agreeing they were high quality for five out of the six webinars. The highest rated webinar was the July 2017 session on materials and digital meet-ups. The lowest rated webinar was in March on connected learning and the SciGirls Seven.
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Key Findings

★ Attendance at the monthly support webinar for educators seemed to decrease after the first five sessions, though there are not great records of how the webinar recordings were accessed.

★ The monthly webinars were consistently rated as high quality, with 90% agreeing or strongly agreeing they were high quality for five out of the first six webinars for which a post-survey was administered.

★ Educators generally had a very positive experience at the three-day SciGirls Code in-person training in April 2017 and post-training survey data showed strong gains in their knowledge and comfort in areas related to facilitating a computer science program for girls.

★ Suggestions were made for more ongoing support, including more opportunities, closer to implementation dates, to review curriculum activities (especially for e-textiles) and more technical support.

★ The program web page, with the curriculum, webinar recordings, and other program resources was well-utilized, with over 19,000 page views in 16 months.

★ Educators used Flipgrid mostly as they were planning and starting their programs to build community and learn from each other. There were four topics or prompts for videos from educators with a total of 59 videos posted and 634 views.

Educator participation in online and in-person trainings

SciGirls Code began offering monthly webinars in February 2017, a few months prior to the in-person workshop. Educators could participate in webinars “live” at the time they are offered access the recorded version on the SciGirls Code website. Based on available data, educators’ “live” attendance at webinars was higher at the beginning of the project, though there are limited data regarding how many times recorded webinars were accessed.3

“CS is challenging but fun as designed by SciGirls with an integrated approach to include hands-on activities, role model inclusion and group work.”

A SciGirls Code Educator, after attending the in-person training

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3 Webinar participation was calculated by sign-in of email at “live” webinars and then survey responses where educators selected if they accessed the recording or participated live. Note that the surveys only stayed open for responses for 10 days after a “live” webinar. This method underestimates participation in three ways:

- A group of attendees from a site could login with one email sign-in;
- An educator who accessed the recording within 10 days did not complete a survey;
- An educator accessed the recording more than 10 days after it was offered “live” (when the survey was closed).
The monthly webinars focused on a topic that was timely to the current work of many of the educators, including the following topics as the program was gearing up:

- Orientation Webinar (Feb 2017)
- Connected Learning and the SciGirls 7 Webinar (March 2017)
- Computational Thinking, Research & Evaluation Webinar (Apr 2017)
- In-person training (Apr 2017)
- Using Role Models and Recruiting & Retaining Girls Webinar (May 2017)
- LRNG & Supplemental Curriculum Materials (Jun 2017)
- Materials & Digital Meetups (Flipgrid) (Jul 2017)

Webinars shifted to a slightly more open format as educators got more involved with program implementation, with a short presentation or updates by the SciGirls Code team on a timely topic, such as more detailed information on e-textiles activities in February 2018 or tips regarding role models in March. The SciGirls Code team encouraged educators to come with examples of what worked well at their site (such as a lesson learned to overcome a technology challenge or a strategy that worked well to engage their girls) and/or with questions for other educators and reserved time during each webinar for these conversations. When the project team knew of a site that had a success to share or that would be willing to talk through an issue they were having, they pre-arranged it in advance so a site representative would be prepared to present.

The support webinars at the start of the project were well-attended by educators.

Educator Attendance at Support Webinars

Starting in Aug 2017, there were no data on who was accessing the webinar recordings

* A post-survey administered after webinars through July 2017 asked if respondents had accessed the webinar recording. The number is an underestimate as it only captured educators who viewed the webinar within two weeks of it being offered and only those who responded to the post-survey. Starting in August 2017, evaluators no longer administered the post-survey and did not track who was accessing the webinar recordings.
The web page with the SciGirls Code webinars were most frequently accessed in April 2017 (near the time of the in-person training).

Available webinar participation data show that five out of 16 partner sites had at least one representative to a minimum of 13 out of 16 educator support webinars. There were two sites that had representation at five or fewer webinars, though as there was limited data regarding access to recorded webinars, their participation is underestimated. For example, one was a school site for which educators may not have been available to attend live sessions. (see Appendix C for more details on participation in webinars).

Experience in webinars

Evaluators administered a post-survey immediately following the first six webinars. After August 2017, educators were asked about the support of SciGirls Code in the post-strand surveys rather than after each individual monthly webinar. Monthly webinars were consistently rated as high quality, with 90% agreeing or strongly agreeing they were high quality for five out of the six webinars. The highest rated webinar was the July 2017 session on materials and digital meet-ups. The lowest rated webinar was in March on connected learning and the SciGirls Seven.
**SciGirls Code monthly webinars were consistently rated as high quality.**

*No respondent indicated "Strongly Disagree (1)"*

**Item: Overall, the webinar was high-quality**

<table>
<thead>
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<th>Webinar Event</th>
<th>Disagree</th>
<th>Agree</th>
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<tr>
<td>Educator Online Orientation (Feb 2017)</td>
<td>38%</td>
<td>62%</td>
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<td>Connected Learning and the SciGirls Seven (Mar 2017)</td>
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<td>4%</td>
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<td>LRNG &amp; Supplemental Curriculum Materials (Jun 2017)</td>
<td>33%</td>
<td>58%</td>
<td>8%</td>
</tr>
<tr>
<td>Materials &amp; Digital Meetups (Jul 2017)</td>
<td>62%</td>
<td>38%</td>
<td>8%</td>
</tr>
</tbody>
</table>

*Source: Post-webinar Surveys*

Post-webinar data were summarized or the project team after each session and many educator suggestions to improve the webinars were incorporated into the subsequent webinars.

Based on post-strand surveys, a majority of educators “Agreed” and “Strongly Agreed” that the webinars offered during the strand were helpful for their role in *SciGirls Code* (90% for Mobile Apps and 67% for Robotics). A majority of educators also “Agreed” or “Strongly Agreed” that attending the webinars were a good use of time, though the percentage decreased between Mobile Apps and Robotics (70% for Mobile Apps and 52% for Robotics).

Interviewees from the winter and spring found the most useful aspects of the webinar to be new information shared from the SciGirls team. Educators found the recorded webinars to be useful, yet many would have preferred to participate in webinars “live,” but were unable to due to their schedules.

The *SciGirls Code* team reviewed suggestions from educators, including schedule requests, and additional content, such as makeathons and troubleshooting: “Maybe you could have a webinar on just preparing for the Make-A-Thon and mapping out all the resources which might help the educator streamline the process more efficiently” and another educator from the Robotics post-strand survey wrote, “Shorter... more tips/tricks on troubleshooting than just what other educators had done.”
In-person training

The three-day SciGirls Code in-person training was held in April 2017 in Saint Paul, Minnesota and attended by 31 educators representing all 16 sites.

The training was highly praised for its quality and value. Educators felt it offered a very positive and supporting learning environment: “Absolutely fabulous training with some of the most engaging, thoughtful trainers ever. [I] really appreciated the variety in training styles.” Additionally, the value and effectiveness of the training was evident in educators’ gains in knowledge and confidence. See Question 3 on the high level of comfort educators have with the technology and how to lead the curriculum activities covered during the in-person training and Question 5 on increases in comfort and knowledge in computer science.

Educators’ top take-aways from the training included increases in knowledge related to the content in the curricular units (16 respondents), the resources and tools curriculum they received to help them implement the program (11 respondents), a feeling of confidence in doing and facilitating the activities (9 respondents), strategies how to engage girls in coding (8 respondents), and a feeling of community in meeting others involved in the project (8 respondents). Educators involved in winter and spring interviews also touted the benefits of attending the in-person training: “I was pleasantly surprised by the training—it was only a couple days, but I thought it was extremely well-designed.”

Despite the success of the training, by the time educators were starting the e-textiles strand, it had been about a year from the training date. An additional workshop or online session could have been helpful:

“Our training we did was amazing. But we learned it a year ago. Shorter, smaller trainings don’t necessarily work, but we would’ve benefited a lot from learning about Lilypad closer to our facilitation of it. We talked about it during webinars and emails, rather than seeing it in front of you, rather than figuring it out together. We could have had another trip out [to a training] halfway through, for ease of learning content as facilitator.”

The educators who did not attend the training had different levels of preparation from their site representatives who did attend. At one site, the educators said she did not receive very detailed information from the site representative who attended the training: “She talked with me a little bit, but she just handed over the curriculum and told me start date. I would come in before class a lot and go through things.”
Use of the *SciGirls* Code Website

Since the launch of the *SciGirls* Code website in March 2017 through the end of the project in July 1, 2018, there have been 809 users visiting the project website. Users totaled 1,627 sessions, averaging 5.72 number of sessions per user.\(^4\) The sessions featured an average of over 4 pages per session, giving the site more than 19,000 page views.

<table>
<thead>
<tr>
<th>Users</th>
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<th>Sessions</th>
<th>Number of Sessions per User</th>
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<th>Avg. Session Duration</th>
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The curriculum main page and the homepage were the most visited pages of the *SciGirls* Code website during the 16 months of project implementation, each with other 2,000 unique page views. The support webinars were the third most visited page, followed by each of the curricular strand overview pages. The page for the first strand, Mobile apps, had more than twice as many unique page views (974) as the last strand, E-textiles (413 views) and a longer average time spent on the page (45 seconds compared with 25 seconds).

The pattern of page views from each strand across the nine-month implementation period of the partner sites shows peak use of each strand, in order, with the Mobile Apps strand in the fall having the highest peaks and the e-textiles peaks showing that programs occurring during a shorter time period and the page views not being as high as the other strands.

**Unique page views of each strand homepage**

*Sept 2017 – June 2018*

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\(^4\) Web stats include internal use by *SciGirls* Code project team.
The majority of sessions and users were from states where partner organizations were located. However, users accessed the website from 20 countries, with the U.S. traffic accounting for 92% of the traffic. Other countries included Brazil (15 users), Spain (3), Malaysia (3) and Canada (2).

Sessions originated from 33 different states and territories, though 28% of sessions were from Minnesota, where the majority of the project team reside. After Minnesota, the most sessions were conducted in New York (460) and New Jersey (366) near the Ramapo Challenger Center. Tennessee and Texas had the highest number of visitors using the site, which could reflect large project teams working on their implementation of SciGirls Code. *(See Appendix C for more website stats.)*

**Flipgrid**

Educators had a grid on the Flipgrid site to connect and work with each other. The SciGirls team wanted them to use videos on the site to, get to know each other, share information and resources with each other and have a forum for Q&A.

Over the year, there were four topics or prompts for videos from educators with a total of 59 videos posted and 634 views. The grids were used primarily as the programs were getting planned and then underway in the summer and fall of 2017. Prompts included “Personal Introductions,” “Thought Provoking Resources,” “Questions, Comments, Issues” and “Program Introductions.” The most used was the “Personal Introductions,” with 33 videos and 413 views.

**Google Groups Listserv**

The project team also ran a listserv under Google Groups to connect educators from the different sites. The project team sent out all information and reminders to the group via the listserv and educators were encouraged to post any SciGirls Code-related questions (including requests for curriculum ideas, technical challenges, pedagogical questions, and anything else), rather than just emailed the project team, so that other educators could respond with their ideas and potential solutions.

There were 73 topics sent via the listserv between July 17, 2017 and June 8, 2018 (the topic could continue in a response thread, with topics having up to 6 replies posted), though the large majority of topics were started by the project team. Examples of topics started by educators included a request for end of program celebration ideas or certificate templates, an ask for help uploading test programs for robotics, and a question on whether any other educators had a rubric to provide girls feedback on their mobile makeathon projects.

Question 3, below, includes more suggestions on how to improve training and support to give educators what they need to successfully implement SciGirls Code.
3. To what extent do educators have what they need from SciGirls Code to successfully implement the program? Are educators comfortable using the technology to implement the program?

Key Findings

- After the in-person training, educators felt well prepared to facilitate the activities and comfortable with the technology in the Mobile Apps and Robotics strands.
- Follow-up webinars focused more on the e-textiles strand, but educators generally felt less prepared and comfortable with that strand.
- Technology issues were experienced most commonly with the Hummingbird platform in the Robotics strand.
- Educators felt stronger support, including tech support and more on the curriculum activities, would have been useful during program implementation, especially during robotics and e-textiles.

Immediately after the training, educators felt well prepared to implement the Mobile Apps and Robotics strands, and a less prepared for the E-textiles strand: More than 80% indicated their preparation for Mobile Apps and Robotics was “Good” or “Excellent,” while 45% rated their preparedness for E-textiles as “Good” or “Excellent.”

The training featured a lot of hands-on time with the Mobile Apps and Robotics technology, and 87% indicated their comfort was “Good” or “Excellent” for both strands. E-textiles was not well covered during the training and only 45% were comfortable with the technology used during that strand after the training.

After the training, a few respondents wanted more time practice with the materials and technology to increase their comfort: “I’m still not comfortable at all with the Hummingbird code programming. The physical aspects I understand but I would struggle leading girls through the coding process or being a helpful resource to them troubleshooting.” For the

“I just need to spend more time planning out and working with e-textiles to become more comfortable. I’m worried that the girls or I will fry circuitry that can’t be replaced.”

A SciGirls Code Educator, after attending the In-person training

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E-textiles was not as well covered during the training as educators would not start implementation of the e-textiles strand for around six months.
e-textiles strand, educators were worried about damaging the circuits, unpracticed at sewing, and desired more time to practice and play around with the materials.

Educators completed post-strand surveys soon after completing a strand and most indicated they were “Moderately” to “Very comfortable” using the strand’s technology. Robotics was the only strand where an educator indicated they were “Not at all comfortable” with the technology.

**Educators throughout the three strands were typically "Moderately" to "Very comfortable" using technology.**

![Comfort Levels](chart.png)

*Source: Educator post-strand survey*

All three post-strand surveys also asked educators if they had issues with the technology. The Robotics post-strand survey specifically asked educators about issues with Sphero Robots and Hummingbird. Educators on the whole seemed to have the most trouble with the Hummingbird platform when compared to technology included in other strands.

**Educators more commonly had issues with the Hummingbird platform.**

![Issue Levels](chart2.png)

*Source: Educator post-strand surveys*

Many of the monthly webinars featured information on different areas of implementation and technology and webinar post-surveys showed a high level of educator understanding in these areas:
• After the March webinar, educators had significantly higher ratings of their knowledge of connected learning, with the percentage of respondents indicating they were moderately or very knowledgeable increasing from 15% before the webinar to 75% after the webinar.
• After the May webinar, all post-survey respondents agreed that they learned effective strategies to recruit girls to participate in the program and to keep girls in the program.
• All respondents agreed that they understood how role models would be used in the project after the May webinar.

While they may have felt confident and well-supported leaving the training, that level of support was not necessarily maintained over the course of the project. A site visit educator noted, “Leaving the training I felt really supported, but when the going got tough, I feel like the support level dropped off, especially with Sphero. SciGirls people said before you asked a question you need to contact Sphero headquarters to figure it out, and I don’t have the time to do that. I need you to tell me what to do, we’re fitting this in on top of a 40-hour work week.” In one site visit, one educator showed high comfort with sewing circuits to light LEDs. However, in another site, educators were regularly checking the instructions on the activity and realized partway through they had given incorrect instructions.

Educators sometimes needed more time to figure out the curriculum than they had available: “We didn’t know how to do it. I don’t have five hours a week to dedicate how to learn everything the girls want to do, so we had to adjust the girls’ expectations because we didn’t know how to help them... Hummingbird was hard; we had lots of tech issues with Spheros.” Educators during winter and spring interviews also noted needing more time for the program. Time intensive elements of the program included implementation and preparation, especially in light of other job positions held by educators, and as cited above, some aspects of the curriculum were more time consuming than others.

During a spring site visit, an educator commented that because they (educators) were not Hummingbird experts, the work of the girls got delayed as they were troubleshooting. Additionally, they were not sure which educators were more successfully implementing the robotics strand, so they did not know who to ask. It was problematic when educators did not know which other educators were comfortable with the technology whom they could direct their questions to: “We were encouraged to use our network, but our networks didn’t know either and I feel like the girls suffered and now going into e-textiles they have a pretty bad attitude.” Additionally, some educators had issues with the technology, inhibiting their ability to facilitate the curriculum. Some educators noted laptops received were not properly functioning and not all iPads worked smoothly.

**Suggestions to Improve the Training/Support**

Educators, especially those who were busy during the school hours were rarely able to attend the webinars “live”: I didn’t get the opportunity to participate in training before implementing the program. The webinars were held at a time that wasn’t convenient for me. It was helpful to listen to them later, but I would have liked to participate. The materials that were provided were excellent.”
A longer training or additional training: A “refresher” course closer to the time of implementation would have been helpful. The e-textiles strand, especially, was more challenging for educators, partly due to the limited training on it. One educator suggested using the ongoing webinars to review the technology and activities. In post-strand surveys, educators suggested additional resource support, content specific training, and additional training or time learning coding or Lilypad:

- Mobile Apps: “It would be useful to have videotapes of some of the more complex sessions to have a better idea how to facilitate them.”
- Robotics: “More guided Hummingbird mini lessons on the coding instead of solely editing the pre-built jLED, Servo and Sensor scripts. Perhaps a mini lesson where teams build a script from scratch on each of these 3 robotic components.”
- E-textiles: “We did not get to the programmable Lilypad products and I am not sure I would have been totally prepared for that because we didn’t do anything with that in the training. The sewable Lilypad was great and I was familiar with how to do that one but I think I would have had some difficulty with the programmable one since I did not have any experience.”

**EDUCATORS**

4. A) How do educators implement SciGirls Code curriculum and activities in their programs (fidelity and adaptations)?

**Key Findings**

- E-textiles was the shortest strand at all of the sites and many educators expressed that they felt pressures of limited time while they were in the final strand and often starting in the Robotics strand. They commented that they pushed the girls and cut activities and program components such as SciGirls Code episodes, using Flipgrid, specific activities and shortening the makeathons.
- Most educators praised the use of Flipgrid to connect girls across sites, allowing them to feel part of a larger project and share their work. Two sites did not use Flipgrid at all and girls at three other sites used it only once or twice.
- Educators sometimes adapted the program by adding aspects, such as incorporating more communication and life skills.
- SciGirls Code sites had between 54 and 112 total hours of programming in the nine-month implementation period, with an average of 92 hours of programming. There was wide variation in the number of sessions per site (between 17 and 67) and length of sessions (1.5 hours to 8 hours).

Most educators implemented the program with fairly high fidelity to the program model and all 16 sites completed at least a portion of activities in all three strands during meetings over the nine-month
implementation period. However, most sites made at least some level of adaptation to the curriculum or other components of the program to better fit their context, girls’ interests and, especially, their time. Many sites experienced time constraints, causing them to cut or shorten activities or makeathons or to reduce role model visits or the use of Flipgrid.

**Time on Strands**

SciGirls Code sites had an average of 92 hours of meeting time with girls at their sites, with a range from 54 hours (CU Discovery Center) to 112 hours (Girl Scouts of Central Texas).\(^6\)

**Number of Total Program Hours per Strand by Site**

On average, sites spent 35 hours on the Mobile Apps strand and 35 hours on Robotics. The average number of hours on the e-textiles strand was 20 hours.

**Average Hours per Strand**

On average, sites spent 35 hours on the Mobile Apps strand and 35 hours on Robotics. The average number of hours on the e-textiles strand was 20 hours.

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\(^6\) Based on attendance sheets. Records for Salem Keizer and the YMCA were incomplete and not included in the mean.
Sites met for varying lengths of time per session, from a minimum of 1.5 hours to a maximum session of 8 hours (with varying meeting times within a site, as well). There was also wide variation in the number of sessions per site (between 17 and 83 (and an average of 47).

A site with a longer average meeting time (typically four hours) explained that they had not been aware of the dosage requirements before the training: “After training, we thought, ‘How are we going to do this?’ We considered weekly afterschool, but that didn’t work with our own schedules.” A few of their girls lived further away and it was hard for them to get to the site after school anyway, so the long weekend days worked well. The educator stated that they typically took more breaks during the longer days, a couple of more brain breaks and a few visits from role models, including a high school student and a researcher. They still also had to cut ‘here and there’ due to time constraints. The girls were more interested in hands-on experiences than in videos or SciGirls episodes, so they usually skipped them.

Educators from winter and spring interviews shared their strategies for maintaining high attendance, including making it fun, building in parental engagement and charging small fee for the program. Educators said, for example, “I started letting them choose music to listen to give them more ownership of the curriculum.” and, “I had a parent meeting at the beginning of meeting and talked about two days per week... I explained to parents that it’s scaffolded.”

Adaptations

Many sites felt they were short on time to get through the curriculum: “We were really pressed for time the entire year.” Their schedules were further complicated when their location, like a school, couldn’t host a program on a regular day. Scheduling make up days was very difficult so they had trouble making up the time. An educator felt that the rush through the strands caused some girls to drop out. “We lost some as they were burnt on it. The push, to move on, it just turns some of them off to it. They wanted more time to play with what they were learning and moving them on down the line.” She stated that after MobileApps, she got stricter about keeping close to the curriculum.

Another educator commented that they underestimated the time it has took the girls to do the activities, especially Hummingbird and MobileApps, since none of their girls had ever done coding before. They adapted by making their final projects less intensive than planned. The girls got really frustrated and stopped wanting to code.

Nine educators wrote that they skipped or abbreviated activities when adapting the program for their site. This was more true for Robotics and E-Textiles as they realized they would not have time to get through all of the curriculum. One educator wrote, “If I had had enough time, I would have followed the
curriculum exactly! Lack of time caused us to skip many activities.”

If a site cut many activities, girls had more limited abilities for the makeathons, as they didn’t have as much experience with the technology.

Other educators modified the program to better meet the interests and abilities of students, including simplifying some of the coding in Arduino or tying it to girls’ interest in film. A site visit educator adapted the program by adding in breaks and other supplemental activities.

One educator, during a site visit, said that they incorporated some elements that were typically part of programs at their organization, which included communication and life skills, such as how to work collaboratively. Instead of the SciGirls episode, they did an outside activity game on communication and related it back to what we were doing. The educator felt that those games brought the girls together: “The games helped develop relationship between girls that sitting in a group wouldn’t necessarily do. When we mixed them up, they didn’t complain.”

Educators documented adaptations they made to the curriculum strand in all three post-strand surveys. In the Mobile Apps and E-textiles strands, educators most often adapted the time spent on activities, either shortening or lengthening.

- “We added lots of time for a few activities. We did all of the activities, but found that 45 minutes for some was not needed and some may have needed an hour.”
- “The Make-a-thon at our site was shortened.”

In Robotics, educators most commonly adapted the curriculum by combining activities. Other adaptations were made due to technical issues: “Only one of four boards from our Hummingbird kit was functional. After having the girls help us troubleshoot and try to figure out what was wrong, we had to change direction in the interest of time.”
Connected Learning using Flipgrid

The use of Flipgrid to connect girls across sites varied by site. Two sites did not use Flipgrid at all during their implementation. Four sites used Flipgrid to watch videos at least six times and another four girls watched three to five times. Girls more regularly used Flipgrid to record videos, with seven sites recording videos on at least six occasions.

Use of Flipgrid at Partner Sites

Educators felt girls benefited from using Flipgrid was it allowed them to see what other girls were doing and to generate and share ideas. It also aligned with the girls’ social media interests and helped build their confidence.

Educators said:

- “Flipgrid was one of their favorite things. They loved making videos to show off their creations and see what other sites were doing. It was a great way for them to see examples and see what other girls their age are coming up with, plus they got to show them what they were doing.”
- “The girls loved sharing and watching other programs. It was also beneficial for the girls that finished projects early to stay engaged.”
- “Social media is such a relevant tool for them, that it was a comfortable way for them to share their projects and ideas. They LOVED it!”
- “Girls got ideas and more confidence in their skills by showing their skills and explaining their projects and seeing others.”
- “Our girls particularly liked seeing how girls are across the country and what they think about because many of them have never been out of [this area]. I also think it was a good motivator for them because they would see how hard the other girls were working and it would positively push them to do the same.”

Time was a challenge to using Flipgrid for six respondents to the Educator Reflection Survey. Two others had girls get distracted when using Flipgrid. A few sites had technical issues working with Flipgrid, especially on tablets, and suggested it be further integrated into the curriculum.
One site visit program that hardly used Flipgrid explained that they did not have a lot of time and the girls were not too interested in connected with other girls from around the country:

“We did not have a lot of time to use it. Again, it was getting the girls to use it. We posted several videos and when they found out other girls were going to watch them then they didn’t want to do it again. Our girls weren’t motivated by the connection piece to other girls. They loved their journals and they were way more about that then sharing things with other sites. Not like in a weird disconnected way, just like in a I’m a 12-year-old girl and I’m interested in what’s in my immediate space.”

Another educator had a similar comment about the lack of interest of their girls in connecting with other SciGirls: “Girls haven’t been that interested in looking at other girls across the country.”

One educator expressed some disappointed that they were not able to connect their girls to other sites, as originally intended with the Connected Learning component:

“I like the idea of them [the girls meeting another group doing what they were doing. They thought it was cool when we told them other groups of girls around the country doing this. They were excited. I wanted them to network with other girls doing the same thing. I wish we’d done that; I think they’d have done that. Or it could have been two groups of kids staring at each other over Skype. I think if we’d been pushed more to do it in live time, we could have made that happen. The outcomes would have been more desirable than outcomes of, ‘Hey watch this video.’”
**EDUCATORS**

4. **B) To what degree do educators use effective strategies for engaging girls in computer science (e.g. SciGirls Seven)?**

**Key Findings**

- Post-training data show significant gains in educators’ knowledge of SciGirls Seven strategies to effectively engage girls in STEM.
- According to educators, they used each of the SciGirls Seven strategies, at least “a little,” during SciGirls Code (and at least half of educators used six of the practices “a lot”). Educators most frequently used the strategies to “Communicate positive feedback on girl’s efforts, strategies, and behavior.”
- Site visits and girls’ survey data confirm the use of SciGirls Seven strategies in their programs.
- “[Exposing] girls to relevant role models” was the least used strategy. Educators suggested making the process easier for role models to participate, better incorporating the role models role into the curriculum and having better access to role models (both locally and via remote).

Educators’ ratings of their knowledge of strategies to engage girls in computer science increased significantly from the educator pre-measure in February 2017 to the Educator Reflection Survey at the end of the program, in June 2018. Looking at matched pairs (educator who completed both surveys), the mean on a five-point scale increased from 3.00 before the project to 4.32 after the project.

**Educator's knowledge of strategies to engage girls in computer science increased significantly from before to after the project.**

Mean on a scale from Very Low (1) to Very High (5)

n= 19 matched pairs

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>My knowledge of strategies to engage girls in computer science.</td>
<td>3.00</td>
<td>4.32</td>
</tr>
</tbody>
</table>

significant difference* (p<.001)

Source: Educator Pre-Survey (Feb 2017) and Educator Reflection Survey (June 2018)

*matched-pairs t-test
Out of all respondents, 28% indicated they had “High” (4) or “Very high” (5) knowledge of strategies to engage girls in CS before SciGirls Code, and 85% indicated it was “High” (4) or “Very high” (5) after their participation.

“Don’t try to be perfect! I always say that anybody can do it perfect, but it’s work to make it original.”

An educator, to the girls, during a site visit

Training data show that educators had gained knowledge on effective strategies to engage girls in computer science during the March webinar, focused in part on the SciGirls Seven and how to engage girls in STEM. The percentage of educators indicating they were “Moderately” or “Very” knowledgeable on the SciGirls Seven increased from 75% before the session to 100% after the session.

**Educators’ levels of knowledge on The SciGirls Seven and how to engage girls in STEM increased significantly from before to after the March webinar, (n=28)**

<table>
<thead>
<tr>
<th></th>
<th>Little or No Knowledge (1)</th>
<th>Somewhat Knowledgeable (2)</th>
<th>Moderately Knowledgeable (3)</th>
<th>Very Knowledgeable (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge about how to engage girls in STEM</strong></td>
<td>7%</td>
<td>18%</td>
<td>46%</td>
<td>29%</td>
</tr>
<tr>
<td>BEFORE the homework and/or webinar</td>
<td></td>
<td></td>
<td></td>
<td>75%</td>
</tr>
<tr>
<td><strong>Knowledge about how to engage girls in STEM now,</strong></td>
<td>50%</td>
<td>50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFTER the homework and/or webinar</td>
<td></td>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: March Webinar post-survey

The educator reflection survey showed that educators used SciGirls Seven practices regularly in their SciGirls Code programs, especially positive feedback on effort and behavior, opportunities for collaborative learning, hands-on projects and encouraging independent and creative thinking (at least 85% of 26 educators indicated they used these practices “A lot.”) They were less likely to regularly communicate educational and career opportunities (46% said “A lot” and 19% indicated “A Little”) or to expose girls to role models (27% said “A lot” and 46% indicated “A little”).
Educators regularly used SciGirls Seven strategies in SciGirls Code programs. (n=26)

As a sign that educators were using “Guide on the Side” strategies to help girls work through problems, one girl said, “Whenever we would ask for help they would just say “I don’t know” or “Figure it out yourself.” It was really annoying.”

Site visits to five programs showed how the SciGirls Seven were being used in the SciGirls Code program. It’s important to note that site visits were only to one session of a program and not necessarily reflective of a typical session at any one site.

Communicate positive feedback on girl’s effort, strategies, and behavior.
- Not at all: 12%
- A little: 88%

Provide opportunities for collaborative learning.
- Not at all: 4%
- A little: 8%
- A fair bit: 88%

Do hands-on, open-ended projects.
- Not at all: 15%
- A little: 85%

Encourage independent and creative thinking and learning.
- Not at all: 15%
- A little: 85%

Emphasize critical thinking.
- Not at all: 23%
- A little: 77%

Make content relevant and meaningful to girls.
- Not at all: 4%
- A little: 27%
- A fair bit: 69%

Communicate educational and career opportunities in CS.
- Not at all: 19%
- A little: 35%
- A fair bit: 46%

Expose girls to relevant role models.
- Not at all: 46%
- A little: 27%
- A fair bit: 27%

Source: Educator Reflection Survey
<table>
<thead>
<tr>
<th>Effective Strategy and Whether Observed during Site Visits</th>
<th>Notes and Examples</th>
</tr>
</thead>
</table>
| **Girls collaborate, everybody participates and communicates fairly.**<br>Present at sites 1, 2, 3, 4, 5 | (P) In all five programs visited, girls sat at tables in groups or pairs.  
(P) Girls were regularly reminded to ask each other for assistance or share tips with other girls. Two girls ended up working together for about 20 minutes, one girl was showing another girl how to sew the cell onto the felt. One girl tried it and was having difficulty so the other girl helped her undo the thread and showed her step by step how to thread the needle through the felt. One girl would hold the felt and the other would push the needle up and through. In another case, another girl was having trouble getting her lights to turn on and her friend noticed her battery was in upside down and fixed it for her. In a third case, one girl got her light to light up and another asked her how she did that.  
(P) Educator regularly has girls turn to their neighbor, “Instead of using wire, we are going to use conductive thread. What does it have around it so it can conduct electricity? Talk to your neighbor!” and “If you have to draw a line, show how it’d go? Just guess. Talk to your neighbor. You took negative to negative. Hmm. How does my electricity flow?” And, finally: “Look at each other’s [work]. Talk about it with your friend.” |
| **Girls work on projects that should be personally relevant and meaningful.**<br>Present at sites 1, 3, 5  
Slightly Present at sites 2 and 4 | (P) Girls chose a theme around which to base e-fashion costumes they were designing and would wear in a fashion show.  
(P) Educator asks girls if they have ever sewn before and then asks the girls to share their sewing experiences.  
(P) The educator brought up the Wonder Woman movie and reminded girls of the cuffs she had and how they would be making cuffs too. The facilitator also asked if the girls had been to Disney World and made connection between the lights in the parade and the lights they were lighting on their cuffs.  
(SP): Girls could choose to create a bracelet or a bookmark. |
<table>
<thead>
<tr>
<th><strong>Girls have opportunity for hands-on, open-ended projects and investigations.</strong></th>
<th><strong>Girls are able to approach projects in their own way, applying creativity, unique talents, and preferred learning styles.</strong></th>
</tr>
</thead>
</table>
| Present at sites 1 and 3  
Slightly Present at sites 2, 4, 5 | Present at sites 1, 2, 4, and 5  
Slightly Present at site 3 |
| (P) Girls got to plan a culminating event, make decisions, and figure out how to make everything work.  

(SP) It was definitely hands-on, but the activity was more intended to build basic skills that they would then be able to apply to a more open-ended project or investigation.  

(SP) Girls were instructed to use a book if they did not know what to do next.  

(SP) The educator mentioned that there were more supplies if they “mess up” and want to start again. | (P) Girls came up with a unique theme (mythology) and each girl got to decide what figure to dress as and how the costume would look.  

(P) Educator said, “designing is up to you.” and “do you want to look at mine and get some ideas?,” and “This is just an example, design your cuff how you want”  

(SP) Girls were given a choice anytime it could be provided, even though the activity was fairly basic to set them up for more complicated activities in the future. Girls got to choose what colors felt fabric (front and back), what shape, where to put the lights, etc.  

(P) One girl asked if she could try to put their on their head instead of wrist and the educator was supportive, saying, “We’ll all do it on our own.”  

(P) I let them have their freedom a lot. My background comes in; I am in school to be MS art teacher. I try to do that here. ‘Here’s a journal idea, but you can decide.’ I have given them a lot of individuality.” |
Girls receive specific, positive feedback on things they can control—such as effort, strategies, and behaviors.

Present at sites 2 and 3  
Not Present at site 4  
Not Observed at site 1

(P) Educator said "good job, high five". There is also positive body language and smiling and laughing from the facilitators. "What did you enjoy?"

(P) Educator said, “Yay, good job. Now do the other one.”

(P) Educator said, “Everybody needs a piece of chalk. If you’re holding a chip and not chalk, that’s not right.” “Then show your engineer next to you. Yay, [girl’s name]. Good job. You can also get up and check w another table.” When it didn’t work for one girl, the educator said, “You didn’t mess up. You’re an engineer. Say, ‘Yay, I learned.’”

(P) Generally positive feedback to different girls from educators: “Excellent,” “well done!” “Perfect!”

(P) When girls were having issues sewing their circuits, the educators had them take a break, “I sense some frustration in the room, maybe a lot. We’re going to take a brain break and do something different.”

Girls encouraged to think critically.

Present at sites 2, 3, and 5  
Not Present at site 4  
Not observed at site 1

(P) The facilitator said: "Think about things you notice about supplies you’re getting," and "Look and make mental notes about things you notice." But the same educator also told girls directly what was wrong and what they needed to do to fix it, "see why it’s not bright? It’s because it’s cross stitched" or "When you tie it off you need to go back through the 3 lines".

(P) Girls had to help think through why the circuits were not working.

(NP) Girls were told what to do by educator

(P) An educator used questions to guide a girl to help her figure out why it was not working. The educator asked the girl to draw her a picture of what she thought she was doing. The educator asked her, "How will you connect it to the top of the battery?" and the girl said, "I found out the problem it was facing the wrong way."

Participant post-survey responses offered more evidence of educators’ use of a SciGirls Seven strategy. Ninety-five percent of participants agreed or strongly agreed that their instructor(s) were positive and encouraging during SciGirls Code.
Participants almost all agreed that their instructors were positive and encouraging.

<table>
<thead>
<tr>
<th>Disagree a lot</th>
<th>Disagree</th>
<th>No opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>5%</td>
<td>26%</td>
<td>69%</td>
<td></td>
</tr>
</tbody>
</table>

The program instructor(s) were positive and encouraging (n=106)

Source: Participant Post-Survey

**EDUCATORS**

5. How do educator attitudes, interest, confidence and knowledge related to computing change as a result of their participation in SciGirls Code?

**Key Findings**

- A comparison of educators’ responses at the beginning of SciGirls Code and after SciGirls Code show the growth of educators’ knowledge, attitudes and comforts related to computer science, including significant pre-post gains (for matched educators) in the following areas:
  - Knowledge of computer science
  - Perception of the usefulness of CS to solve problems and
  - Perception of the value of CS to make a meaningful difference in people’s lives

Educators generally had high interest and positive views of coding before the start of the project. In the pre-survey, 88% of respondents indicated their interest in teaching girls coding was “High” or “Very high.” Additionally, most educators indicated that coding could make a meaningful difference in the world and help solve real-world problems (with 83% and 70% indicating “High” or “Very high,” respectively).

Educators’ ratings of their knowledge of coding were initially very low, with only 11% of respondents indicating it was “High” or “Very high.” Despite this, educators still felt fairly comfortable leading youth in coding before starting with SciGirls Code (with 55% indicating “High” or “Very high”).

Looking at all respondents, a higher percentage of all Reflection survey respondents indicated high or very high levels of knowledge, interest and confidence in computer science. Their knowledge of computer science showed the most noticeable increase by the end of the project, with 60% of...
respondents indicating it was “High” or “Very high.” In addition, all respondents had positive views of the usefulness and value of computer science at the end of project.

**Overall, educators rated their knowledge, interest and confidence in computer science higher after the project.**

All Pre-survey respondents (n=36)
All Reflection Survey respondents (n=26)

*Percentage selecting High (4) or Very High (5) on a scale from Very Low (1) to Very high (5)*

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>My current level of knowledge about computer science*</td>
<td>11%</td>
<td>60%</td>
</tr>
<tr>
<td>My perception of the usefulness of computer science to solve problems in the world.</td>
<td>70%</td>
<td>100%</td>
</tr>
<tr>
<td>My comfort leading youth in activities related to computer science.</td>
<td>54%</td>
<td>80%</td>
</tr>
<tr>
<td>My perception of the value of computer science to make a meaningful difference in people’s lives.</td>
<td>83%</td>
<td>100%</td>
</tr>
<tr>
<td>My interest in teaching girl coding/My interest in engaging girls in computer science.</td>
<td>88%</td>
<td>93%</td>
</tr>
</tbody>
</table>

*Source: Educator Pre-Survey (Feb 2017) and Educator Reflection Survey (June 2018)*

*Note: Pre-survey used “coding” instead of “computer science”*

Matching educator’s pre-post responses (for 19 educators responding to both surveys), there was significant difference in educator’s ratings of their knowledge of computer science, their perception of the usefulness of CS to solve problems in the world and make a meaningful difference in people’s lives.
Individual educator’s ratings of their knowledge, interest and confidence in computer science had significant increases in some areas.

n= 19 matched pairs

Mean on a scale from Very Low (1) to Very High (5)

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Significant difference*</th>
</tr>
</thead>
<tbody>
<tr>
<td>My current level of knowledge about computer science.</td>
<td>2.67</td>
<td>3.72</td>
<td>(p&lt;.001)</td>
</tr>
<tr>
<td>My perception of the usefulness of computer science to solve problems in the world.</td>
<td>4.06</td>
<td>4.67</td>
<td>(p=.001)</td>
</tr>
<tr>
<td>My perception of the value of computer science to make a meaningful difference in people’s lives.</td>
<td>4.28</td>
<td>4.72</td>
<td>(p&lt;.05)</td>
</tr>
<tr>
<td>My comfort leading youth in activities related to computer science.</td>
<td>3.79</td>
<td>4.21</td>
<td></td>
</tr>
<tr>
<td>My interest in engaging girls in computer science.</td>
<td>4.42</td>
<td>4.58</td>
<td></td>
</tr>
</tbody>
</table>

Source: Matched Pairs from Educator Pre-Survey (Feb 2017) and Educator Reflection Survey (June 2018)
Note: Pre-survey used “coding” instead of “computer science”
*Matched-pair t-test

“I was extremely unsure of myself and my knowledge beforehand and now I feel more confident because I not only understood what was happening, but could execute it as well. STEM has never been my strong suit, but now I feel great about it!”

An educator after in-person training

After the in-person training, educators noted their increased comfort with computer science or coding, an area where they had not felt confident in the past. Educators also noted during winter and spring interviews that they became more comfortable with the content and learned about coding applications: “The program is fantastic. I learn things from it. I’m having a great time with the robotics unit. So fun. It’s something I can understand and I’m totally on board with and I don’t struggle as much as I did with the mobile unit.”

Educator had enough interest, skills and confidence that most planned to continue their CS programs somehow, after the completion of SciGirls Code.
6. To what extent are educators aware of the educational and career opportunities in CS and convey them to the girls in their programs?

**Key Findings**

- The percentage of educators who rated their awareness of resources and programs related to coding available for girls as “High” or “Very high” increased from 22% before their SciGirls Code experience to 77% after the program.
- A comparison of matched pre-post showed a significant increase on this item.
- Role models introduced educational and career opportunities in many of the sites, but many educators experienced challenges arranging role model visits (including finding a role model and making time for the visit). They offered suggestions on how to improve that component, such as doing more virtual visits, having it built into the curriculum, and longer-term relationships with role models.

The SciGirls Code curriculum included episodes of the SciGirls television program, which exposed the educators and the girls to different careers in computer science. In addition, sites were supposed to have a role model visit once during each of the three strands.

Educator ratings of their own awareness of resources and programs related to coding available for girls was not very high before their SciGirls Code experience, with 22% indicating their current level was “High” or “Very high” and most educators (39%) rating it as “Medium.” After the program, 77% of educators agreed with the statement.

**After participating in SciGirls Code, educators indicated much higher knowledge of other CS resources and programs.**

All Pre-survey respondents (n=36)
All Reflection Survey respondents (n=26)

**Percentage selecting High (4) or Very High (5) on a scale from Very Low (1) to Very high (5)**

<table>
<thead>
<tr>
<th>My knowledge about other computer science resources and programs available for girls.</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22%</td>
<td>77%</td>
</tr>
</tbody>
</table>

*Source: Educator Pre-Survey (Feb 2017) and Educator Reflection Survey (June 2018)*

“I hope to inspire young women to consider career choices they may not have felt a comfort level in exploring before. Personally and professionally, I want to encourage and nurture girls to be scientifically literate. I also want to increase my understanding of coding and its importance in the lives of 21st century learners.

*An educator, in the pre-survey*
There was a very significant increase in this item for the 19 educators who completed both the pre-
survey and post-survey.

**Analysis of matched pairs showed significant increases in knowledge of CS resources.**
n = 19 matched pairs

Mean on a scale from Very Low (1) to Very High (5)

<table>
<thead>
<tr>
<th>My knowledge about other computer science resources and programs available for girls.</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.42</td>
<td>4.11</td>
</tr>
</tbody>
</table>

Source: Educator Pre-Survey (Feb 2017) and Educator Reflection Survey (June 2018)

Information on education and career opportunities was embedded in the curriculum, including videos showing women working in computer science or coding and an activity where girls make a slide show of females working in CS. Since the girls were middle-school age, the focus was less on career information and more to get them in the pipeline for the preparatory courses in high school.

Educators reported on whether they thought girls’ understanding of careers and educational pathways in computer science increased during each strand. When looking across each strand, educators reported similarly across the strands that girls’ understanding “Increased a lot” (selected by between 22% and 41% of educators). A third of educators felt that the girls were least sure about robotics.

**Educators thought most girls’ increased their understanding of career options and educational pathways in computer science.**

<table>
<thead>
<tr>
<th>Mobile Apps (n=22)</th>
<th>Robotics (n=21)</th>
<th>E-textiles (n=24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not increase</td>
<td>Slight increase</td>
<td>Moderate increase</td>
</tr>
<tr>
<td>5%</td>
<td>14%</td>
<td>41%</td>
</tr>
<tr>
<td>Increased a lot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Educator post-strand surveys

**Connecting the Girls to Role Models**

An educator thought the role model component was helpful as the professional women working in CS were able to talk about how whatever the girls are learning are applicable in real life. Role models brought a variety of experiences to the girls. One role model often went to conferences and would talk with the girls about her experience: “She’s a mobile designer. She brings back trinkets. She talks of job opportunities; the real world experiences.” Another role model would talk with the girls about her
company: “She came in and talked about her story, about the startup worked on. She talked about the culture of her company.”

However, sometimes booking even one more role model visit was a challenge: “We did find it challenging, though, coordinating schedules with role models, getting some interested role models to complete the training and commit to a date to come, etc.” One educator wrote about the time spent managing the role model component due to processes at their organization and for the project: “We had to walk potential role models through our site’s on-boarding process, in addition to getting them set up with FabFems. We needed forms signed and also for their company to approve of them leaving work during the day to volunteer. I didn’t initially see this as a big deal, but out of the pool of 15 role models our site initially recruited who seemed enthusiastic to participate, we were only able to ‘onboard’ 2 of them fully. It felt at times that there were a lot of needless barriers to creating a meaningful connection.”

One educator would have liked a longer-term relationship with the role model, or at least multiple visits: “I feel like the role model could have come for more sessions. After one session they’re gone. We invited one back to makeathon, but she was going out on maternity leave. It might have been better to have deeper more prolonged engagement.”

A project team member felt that they could have done more communication on the role model piece to educators, outside of the training and webinars to make it feel more embedded in the program rather than something extra for them to take care of. “The girls very much enjoy interacting with role models! Our app design role model was particularly great - she was very dynamic, shared some really interesting examples with the girls, and she brought app design challenge cards from her business that the girls could play with. I wish we’d been able to schedule more role model visits!”

One program site had a staff person at their organization who arranged role model visits and each educator also tapped their professional and personal networks looking for SciGirls Code role models. They had a total of four role model visits, though they noted they were not “super intentional” with the first one as they were learning how to have them be there and work with the girls.

At a site visit program, the educator said that girls seemed more comfortable with a role model at the program and wanting to ask more questions by the fourth role model visit. The educator felt it was partly due to the educator providing better directions to the role model: “Definitely being more forthright with [the role models] about what we were looking for helped that interaction with them. I’ve told my mentors that my big goal for them is to learn about their cool job and get to know you as a person. Our girls were asking will we see them again at the end of the session.”

This site, however, did not make the time to make use of the role model videos on Flipgrid: “We don’t have time to learn to use this [Flipgrid] or think about how to incorporate it. This is the easiest thing to cut. We didn’t even go on it.”

To improve the role model component, educators suggested:
Having at least one role model who visits multiple times and develops a relationship with the girls and becomes more familiar with the program.

Additional role models to help expose the girls to many different careers.

Ideas for how a role model could help with the curriculum would have been helpful, especially when most programs felt pressed to for time to complete the strands.

More local role models were suggested by three educators.

Educators felt they could have been more prepared for how to handle a role model visit, such as how to set-up the visit for the girls and role models to have positive interactions and ways to connect.

**EDUCATORS**

7. **To what extent do educators understand the nature of computer science and computational thinking and facilitate the development of this knowledge with the girls?**

**Key Findings**

- Educators showed significant growth in their abilities to show girls how CS is relevant to their lives, with a mean increase from 3.68 on the pre-survey, to 4.37 on the post-survey (matched pairs).
- Educators have a high interest in engaging girls in computer science, and they are confident in their ability to help youth develop critical thinking or problem-solving skills.

“I found the structure of concepts within computational thinking very important, as they tend to follow the patterns I have seen and learned to intuit in the programming I’ve done. I also appreciate the parallels of practices to the scientific method, but also their extensions to the perspectives that inquiry creates. I want to know more about how implementation of this framework looks and how to assess participants.”

An educator, in “homework” in the LRNG platform

Educators indicated significant growth in their abilities to show girls how CS is relevant to their lives, with a mean increase from 3.68 on the pre-survey, to 4.37 on the post-survey. Their pre-survey ratings of their abilities to help youth develop critical thinking or problem-solving skills was so high that there was not much room for growth.
Educator’s knowledge of strategies to engage girls in computer science increased significantly from before to after the project.  

n= 19 matched pairs

*Mean on a scale from Very Low (1) to Very High (5)*

<table>
<thead>
<tr>
<th>Strategy Description</th>
<th>Pre</th>
<th>Post</th>
<th>Significant Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>My ability to show girls how computer science is relevant to their lives</td>
<td>3.68</td>
<td>4.37</td>
<td>(p&lt;.05)</td>
</tr>
<tr>
<td>My ability to help youth develop critical thinking or problem-solving skills</td>
<td>4.32</td>
<td>4.36</td>
<td></td>
</tr>
</tbody>
</table>

Source: Educator Pre-Survey (Feb 2017) and Educator Reflection Survey (June 2018)

The June support webinar for educators focused on building girls’ computational thinking skills, and educators’ post-survey responses showed they felt fairly confident after that webinar.

**Educators knew how to show girls that or CS is relevant and can make a difference and how to build computational thinking skills (March 2017) n=30**

*Note: No respondents indicated Strongly Disagree*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree (2)</th>
<th>Agree (3)</th>
<th>Strongly Agree (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I know how to show girls that coding or CS is relevant to their lives</td>
<td>53%</td>
<td>47%</td>
<td></td>
</tr>
<tr>
<td>I know how to convey to girls how coding or CS can make a difference in the world</td>
<td>47%</td>
<td>53%</td>
<td></td>
</tr>
<tr>
<td>I understand how to build girls’ computational thinking skills</td>
<td>3%</td>
<td>60%</td>
<td>37%</td>
</tr>
</tbody>
</table>

Source: March 2017 webinar post-survey

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"Take a deep breath and say ‘I got this.’ Do this with your fingers [point to head] and say, ‘I’m growing dendrites and making myself smarter.’"

An educator, to the girls, during a site visit

An educator wrote about his/her understanding of computational thinking:

“Computational thinking doesn’t have to involve computing, but is more powerful when it does. When working with individuals who are intimidated by coding/computer science, it’s helpful to create opportunities for them to dip their toe in the pool. So, creating and leading activities applying CT without CS can build confidence and lay ground for when computing is eventually rolled in--I’m excited to develop, work with, and lead CT-based curricula.”
An educator felt she had become better at letting girls “figure it out,” which came in part from the training from SciGirls Code to be more of a ‘guide on the side,’ but also because the educator was not as confident in their own abilities to solve the problem.

Project team members thought educators would not use the term computational thinking and instead refer to it as problem-solving or debugging. They stated that they hoped educators will allow the program to be really girl-led and to allow the girls to be creative, to struggle, and to be as self-directed as possible.

**EDUCATORS**

8. What other impacts do educators experience as a result of their participation and training?

**Key Findings**

- Educators were all able to use what they learned in the SciGirls Code educator training in their work outside of the program.
- Sites were planning to continue SciGirls Code programming or similar CS programming opportunities at their site and would apply different parts or all of the curriculum.
- Educators also gained different pedagogical practices, including effective strategies for engaging girls, experience with Connected Learning, role models, and technology and materials.

Educators were exposed to many different types of technology and introduced to a variety of effective practices through their participation of SciGirls Code. Other gains of educators were that their knowledge and experience will apply to other work outside of SciGirls Code. After the in-person training, all educators who completed the post-survey indicated they would apply what they learned and would share the information they learned in the training with their co-workers.

**All educators agreed or strongly agreed that they will utilize what they learned in the training by either applying and/or sharing the information.** (n=29)

*Note: No respondents indicated Strongly Disagree (1) or Disagree (2).*

<table>
<thead>
<tr>
<th>I can apply what I learned in this educator training to my work outside of the SciGirls Code program.</th>
<th>Agree (3)</th>
<th>Strongly Agree (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24%</td>
<td>76%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I plan to share what I learned in this training with my coworkers who are not involved in the SciGirls Code program.</th>
<th>Agree (3)</th>
<th>Strongly Agree (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28%</td>
<td>72%</td>
<td></td>
</tr>
</tbody>
</table>

*Source: In-person training post-survey*
Future Program Ideas (Content and Pedagogy):

A site visit educator described their plans to use what they learn through implementation of SciGirls Code to inform their OST programs, including re-writing robotics curriculum: “I have learned a lot about how to teach this topic. We are revamping tech programs and how we teach robotics. I’m redoing our robotics camp based on how this went; taking what we learned and use it for our own means. I don’t think we’ll do two Saturdays a month. We are looking at more day camp and spring break camp or full time OST workshops. Taking what we learned... we are trying to get out of the one-and-done and moving toward deep dive into content; what coding is.”

Growth Mindset: A few educators mentioned that they have developed a growth mindset and/or that they had strategies of how to help develop a growth mindset in their participants. One educator wrote, “I developed more of a growth mindset than I had before attending the training.” Another educator, after a webinar on “supplemental curriculum” noted that sh/e would use the, “F.A.I.L. acronym... First attempt in learning!! LOVE IT!” in her program.

Connected Learning: The project incorporates recent technology to support connected learning, such as testing the LRNG platform and using Flipgrid (short videos for educators to share with each other and for “Digital Meet-ups” between program sites so that girls can be see what other SciGirls Code girls in another site were working on).

Working with Role Models: Educators found high value from the May webinar where they learned about the role model component and learned about FabFems. Getting connected to local role models working in computer science or coding and learning how to effectively use role models in girl programming was an area of growth for educators.

SciGirls Code made efforts to bring educators together so that they can serve as a resource for each other and share best practices and challenges (partly to avoid overwhelming TPT in providing all types of support to 16 sites, which would not necessarily be a sustainable model). The monthly webinars, use of Flipgrid and LRNG and the GoogleGroup listserv all help to connect educators together and encourage sharing and collaboration. As one educator wrote, it was exciting to be part of the community: “It is so refreshing and inspiring to be surrounded by strong, female role models, ready to transfer excitement about STEM to girls all over the country.”

During the winter and spring interviews, one educator described the value of being able to share experiences she had as a young girl with the youth. She said, “When I was growing up I was in STEM program and into electronics really heavily because both of my parents worked at intel so being able to continue that has been beneficial to me because I know it’s living on because I’m making it live on.”
Apps

10-2-17

I learned that it is not always right at first.

App Ideas
Tour guide of museums.

Dry and Moist

Test 1
Dry: 301

The mud was really dry.

Soil: 922

Was moist but kinda dry a little.
1. Who are the role models involved?

Key Findings
★ The project aimed to have one role model visit (in-person or online) for every site during each of the three curricular strands.
★ There were 24 role models who were confirmed to have visited a SciGirls Code program and another 21 role models recruited who did not visit a program (based on available records). In addition, five role models served as a role model using Flipgrid videos to interact with participants.
★ Role models were predominantly White/Caucasian (71%). Three-quarters were between the ages of 18 and 35.
★ When asked why they wanted to be role models, most respondents shared that they wanted to encourage more girls in STEM or share their story.

Role models were recruited via the FabFems directory of women working in STEM. The project team looked specifically for women working in coding or computer science jobs who lived near the partner organizations and could potentially travel to visit the programs in-person. Potential role models were sent some questions to help set them up as a SciGirls Code role model, including asking what strand they have experience with (of the three curricular strands that were part of this program), what sites they might be able to visit in-person and whether they were willing to serve as a virtual role model for any programs.

FabFems helped make sure that every site was connected to at least one role model (which was true for every site except for SpectrUM in Montana). They identified at least three models for five different partner sites. One site had thirteen role models from a local tech company and another had a virtual visit from a role model at JetBlue, their corporate sponsor. After recruiting, training and connecting role models to sites, FabFems left it to educators to continue conversation with the role model and schedule a visit.

In addition to these recruitment efforts at the national level, many partner sites also helped identify role models in their area by contacting local companies or tapping their networks or existing connections. These role models included themselves (with a background in technology and working at a science museum) and parents of girls participating in the program. A project team member noted the difficulties finding role models for each of the sites that were near each site. They worried that it could perpetuate...
a myth that you have to be a “fancy person from California to have a career in computer science” while they wanted to show that women working in CS were local and reachable. There were 24 role models who were confirmed to have visited a SciGirls Code program, according to attendance sheets. Twenty-one other women were recruited to participate as role models (including 10 from the same company in Iowa), but attendance sheet records do not show that they visited a program.

In addition, five role models posted videos on Flipgrid about themselves and their work. They also exchanged Flipgrid comments with SciGirls Code girls who accessed the videos and asked a question or by posting responses on the SciGirls Code videos. The role model videos on Flipgrid had between 162 views (of the first video, posted on Nov 1, 2017) and 4 views (for a role model video posted on Jun 5, 2018).

Demographics

SciGirls Code role models represented a variety of computer-related STEM careers with the biggest concentrations in computer science, engineering (including computer, electrical, industrial and mechanical), software and information technology. Nearly one quarter (22%) of the role models worked in the field of computer science. Other fields include robotics, design, environment and manufacturing.

Educators most commonly indicated that the content covered during SciGirls code was "Slightly related" to their own work or area of expertise. (n=14)

<table>
<thead>
<tr>
<th>Slightly related</th>
<th>Moderately related</th>
<th>Very related</th>
</tr>
</thead>
<tbody>
<tr>
<td>64%</td>
<td>21%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Role models were predominantly White/Caucasian (71%). About 40% of respondents to the Reflection Survey were between the ages of 18 to 26 and another 35% were between 27 and 35 years old. Just over half (53%) had obtained their Bachelor degree and 36% had obtained their Master’s degree or higher.
Over one-third (38%) of role models heard about the opportunity from a colleague at their company or institution.

Most role models heard about the opportunity to be a role model from a colleague at their company or institution, or from another friend or colleague.
Nearly one out of five (19%) role models indicated that they have had experience being an informal mentor, and the same number said that they have shared personal stories, interest and experiences with youth.

**Role models had various related experiences prior to SciGirls Code.**

<table>
<thead>
<tr>
<th>Experience</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have served as an informal mentor (i.e., talking with a youth’s family or a neighbor)</td>
<td>19%</td>
</tr>
<tr>
<td>I have shared personal stories, interests and experiences with youth</td>
<td>19%</td>
</tr>
<tr>
<td>I have led youth in a coding/computer science learning activity</td>
<td>14%</td>
</tr>
<tr>
<td>I have talked to youth about my education and work path related to coding/computer science</td>
<td>12%</td>
</tr>
<tr>
<td>I have served as a role model in a girls’ STEM or computer science-related program</td>
<td>10%</td>
</tr>
<tr>
<td>I have hosted youth visiting my office/lab space</td>
<td>10%</td>
</tr>
<tr>
<td>I have presented on a coding/computer science concept to youth</td>
<td>7%</td>
</tr>
<tr>
<td>I have led youth in a coding/computer science learning activity</td>
<td>5%</td>
</tr>
<tr>
<td>I have shared personal stories, interests and experiences with youth</td>
<td>5%</td>
</tr>
</tbody>
</table>

When asked why they wanted to be role models, most respondents shared that they wanted to encourage more girls in STEM:

- “I believe in sharing knowledge and encouraging youth to learn more in STEM space, we need more girls in science, technology, engineering and Maths, and anything I can do within my capacity to make that happen I will do.”
- “I decided to participate because as a Woman in STEM I see a lack of young women in the STEM field. So I want to be able to let the youth know that your gender or race does not limit your ability to thrive in this field.”
- “I thought that this would be a great opportunity to teach young girls about the opportunities available to them if they choose a computer programming or engineering route.”
Others felt they had a story to share:

- “As a female and Latina in Tech with a low-income household upbringing, I feel a strong need to open the eyes of girls about STEM opportunities around them. I’d love to get girls interested or maintain their interest in coding. I’d like them to own being smart and help them feel comfortable with tech.”

- “Growing up, I didn’t know about the opportunities in Computer Science fields - I didn’t realize that it gave me the opportunity to be creative, problem solve, and have a lot of fun at work! It wasn’t until college that I learned about these opportunities, and at that point it felt like I was constantly behind (as many of the men in my classes had taken CS courses in high school and earlier). I want to encourage young women to learn about opportunities and see how fun it can be to learn about technology!”

On post-strand surveys, educators most commonly indicated they had one person serving as a role model during that strand. At least two sites did not have a role model visit in a strand and a few sites had a six or more role models visit.

**Most programs had one role model visit their program per strand.**

![Bar chart showing the number of role models per strand for different types of programs: Mobile Apps, Robotics, and E-textiles.](chart.png)

Source: Educator Post-strand Survey
2. How do role models perceive the effectiveness of the role model training and support?

Key Findings

★ Two sessions of a role model training were held in August 2017 and the recordings were posted online to help prepare SciGirls Code role models.
★ Of 24 role models who visited a SciGirls Code program, seven (29%) confirmed that they participated in or accessed the recording of the two sessions of the role model training.
★ Those who did participate in the training found the sessions useful. Following the training, role models felt most prepared to share personal information to connect with the girls and to describe their job in an engaging way. They felt least prepared to use effective questioning techniques and lead a hands-on activity.
★ Role models asked for more information on what SciGirls Code expected of the role models including their specific roles and project details and goals, and how to conduct a visit remotely.

Two sessions of a role model training were held in August 2017 to help prepare SciGirls Code role models (recruited from partner sites or the national team). The live sessions were attended by four role models and then the recordings were accessed online by at least 15 other role models.

The role models who participated in the trainings did not necessarily visit a SciGirls Code program. In fact, ten role models who completed the training were not listed in attendance sheets or other records as having visited a SciGirls Code program or serving as a Flipgrid role model. Of the 24 identified role models who visited a SciGirls Code program, seven (29%) confirmed that they participated in or accessed the recording of the two sessions of the role model training. The training status of 12 role models is unknown. The other 21% (5 role models) confirmed they had not participated in the training sessions.

Role Model Reflection survey respondents participated in the training by watching the recorded version online (82% watched Part I online and 88% watched Part II online). The majority of role models felt that the overall quality of both Parts I and II were “Good” or “Excellent.” Feedback about Part I included that the session was “a good overview of the program,” and “an appropriate length and detail, answering

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7 Post-surveys were received from two of the three role models attending “live” and 12 out of the 15 accessing the recording.
8 Programs may have had role models visit their program and not recorded it on the attendance sheet or responded to email requests for information.
9 Based on role model post-training survey and the role model reflection survey.
10 They may have accessed the session recordings but skipped the post-survey. Responses to the post-survey were requested at the completion of the training, in part to record their training completion and in part to provide feedback on the training.
11 In the role model reflection survey, the role model indicated they did not complete session 1 or 2 of the role model training.
general questions and providing resources for more specific questions,” though one respondent shared that the content, while useful, was not new to them because of prior participation in in-person NGCP training. Another respondent commented that Part I was too long, and two respondents expressed frustration about technical details including downloads to watch videos and clicking on links that had been posted in the chat boxes.

Part II had slightly higher ratings in how useful the content was in preparing them to become a role model. One role model felt that Part II got “closer to the heart of the program” and overall, more role models indicated that Part II’s usefulness of content to prepare them as a SciGirls role model as “Good” or “Excellent.” Another role model shared that Part II was valuable: “I thought session II was a bit more helpful in terms of technical skills and information about the programming.” One shared that while the content was more helpful in Part II, it was still too long.

The majority of role models felt that the overall quality of Session 1 was good or excellent. (n=17)

<table>
<thead>
<tr>
<th>Overall quality of Session 1</th>
<th>Poor (1)</th>
<th>Satisfactory (3)</th>
<th>Good (4)</th>
<th>Excellent (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usefulness of content to prepare me as a SciGirls Code role model</td>
<td>6%  12%  47%  35%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The majority of role models felt that Session 2 had content that was useful to prepare them as a SciGirls Code role model. (n=17)

<table>
<thead>
<tr>
<th>Overall quality of Session 2</th>
<th>Poor (1)</th>
<th>Satisfactory (3)</th>
<th>Good (4)</th>
<th>Excellent (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usefulness of content to prepare me as a SciGirls Code role model</td>
<td>6%  6%  53%  35%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Role model post-training survey

Following the training, role models felt most prepared to share personal information to connect with the girls and to describe their job in an engaging way. They felt least prepared to use effective questioning techniques and lead a hands-on activity.
All role models indicated that they felt moderately to very prepared to describe their job or work in an engaging way. \( \text{n=17, unless noted} \)

No respondents indicated “Not Prepared (1)”

In the Reflection Survey after their role model experience, role models all agreed or strongly agreed that they felt prepared to be an effective role model. About 90% of role models agreed or strongly agreed that they understood the goal of the project and were prepared for helping with a learning activity. Three role models out of ten agreed or strongly agreed they understood the program’s expectations for role models.

All role models agreed or strongly agreed that they were prepared to be an effective role model.

**Source:** Role model Reflection Survey
When asked about the most valuable thing role models learned in the training, two role models said that they learned about how to prepare for their visit. Role models also shared that it would have been helpful to have more information on what SciGirls Code expected of the role models including their specific roles and project details and goals, and how to facilitate remotely. A couple of role models had suggestions for technical support that would make their participation easier as well. An educator felt that while the role model training was a good idea, it seemed like a lot to ask them to do two hours of training for a one-hour visit. Instead, a 30-minute conversation to fill the role model in might be more realistic.

During site visits to five sites, evaluators were able to observe two role model visits. A mother of a participant who worked in computer science had visited the program about once per month. She mentioned that she would have liked more direction on how to be a more effective role model: “My advice is to be more specific on my role. I want to be useful, not just sit here for two hours.” She had participated in the SciGirls role model training webinars, but felt they were more about the program and less of what to do as a role model. She would have found it helpful to know the plan for what the program would be doing in the next few weeks so she could plan her visit and look for other volunteers.

Educators had varying levels of communication with role models prior to a visit. At one site, the educator sent the role model questions that she wanted her to talk about with the girls, “What are they doing? What are their struggles? At the time the girls were struggling with working in groups, so I wanted her to talk about that her projects working with groups and what’s that like.”

Having a role model visit during a makeathon was challenging for many sites. When the timing didn’t work out for one site, they asked the role model to watch the girls’ Flipgrid videos and post replies.
3. What content, activities, and strategies do role models use with the youth participants? How do role models connect with participants (virtually, in-person, lead activities, etc.)?

Key Findings

- Every partner site had at least one role model visit, in-person or online, during the 9-month program, and one site had 12 total visits.
- Seven out of the 16 sites had a role model visit in each of the three strands.
- Thirty-one percent (25) of role model visits were online, with a “live” virtual connection.
- Five role model videos on Flipgrid had a total of 329 views by participants.

The number of role model visit greatly varied by site, with a range of 12 confirmed visits to just one confirmed role model visit. Role model visits were about equally represented for each strand, with six out of 13 partner sites reporting a role model visit for each strand. The number of role models visiting during the e-textiles strand was highest due to two sites with six or more role model visits. According to the records available, in-person visits occurred more often than virtual visits (56 out of 81 total role model visits, or 69%).
Programs had between one and twelve Role Model Visits. Seven programs had a role model visit for every strand.

Number of Role Model Visits Per Strand by Site

<table>
<thead>
<tr>
<th>Site / Category</th>
<th>MobileApps</th>
<th>Robotics</th>
<th>E-textiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>MobileApps</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Robotics</td>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>E-textiles</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
</tbody>
</table>

Darker color represents an in-person role model visit; Light color represents virtual role model visits.

Source: Educator Post-strand Surveys

Seven out of the 16 sites successfully had a role model visit, either in-person or virtually, in each of the three strands (according to the records). Seven other sites had a role model visit in two strands and the other two partner sites had a role model during one strand only.

Number of Strands with a Role Model Visit by Site

- Role model visit in all three strands: 7 partner sites
- Role model visit in two strands: 7
- Role model visit in one strand: 2

Source: Attendance sheets and Communications
Of Role Model Reflection Survey respondents, six of the 14 role models made one in-person or virtual visit, and four role models visited in-person four times.

**Number of Times Role Models visited a program in-person and/or virtually (n=14)**

<table>
<thead>
<tr>
<th>In-Person</th>
<th>1 Time</th>
<th>2 Times</th>
<th>3 Times</th>
<th>4 Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not At All</td>
<td>-</td>
<td>↑↑↑</td>
<td>-</td>
<td>↑↑↑</td>
</tr>
<tr>
<td>Virtual</td>
<td>-</td>
<td>↑↑</td>
<td>↑</td>
<td>-</td>
</tr>
</tbody>
</table>

Half of the role models did not attend the makeathon “showcase,” and the four who did were also role models who were able to attend in-person three or four times.

Using Flipgrid to connect role models to girls worked well. Five women created a short video about themselves, and girls could watch and post comments. Role models were asked to reply to girls’ comments and questions to their videos and also to post comments on girls’ videos of their makeathon projects. Many video responses from girls answered a question posed by the role model during one video, such as “What do you like about STEM?” Other comments were mostly to thank the role models and offer their praise of the video or the information she shared. One girl said, “Thank you for inspiring us.” and another girl said, “Your description of your childhood basically sounds exactly like mine.” Other posts included questions from girls, including follow-up question on a personal topic, such as what the role model liked to bake or how to balance work and other interests.

**Role model videos on Flipgrid**

<table>
<thead>
<tr>
<th>Role model Video Post Date</th>
<th>Number of Views</th>
<th>Number of “Reactions”</th>
<th>Number of “Replies” (Video Responses)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 1, 2017</td>
<td>163</td>
<td>70</td>
<td>11</td>
</tr>
<tr>
<td>Jan 9, 2018</td>
<td>54</td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td>Jan 12, 2018</td>
<td>90</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>Apr 5, 2018</td>
<td>18</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>June 5, 2018</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

*Most reply videos were created by at least two girls.

One role model used Flipgrid, recording a video about herself and further shared that the experience was “satisfactory.” She enjoyed being able to provide feedback on projects that the girls presented on Flipgrid, but felt challenged by “making sure that [she] was clear and concise when giving feedback.”
After a makeathon showcase on the final day of the program at an observed site, a role model who had visited the program regularly, gave a brief speech to the girls about computer science. She told them CS can be “really, really fun. It is the fun part of problem solving.”

She asked the girls what “empowered women, empower women” means to them. She explained that women who are in power can inspire others to do big things and better things: “You get to be creative and share what you learn with other girls and other boys. You can lift other people to try new things.”

The role model described her workplace very positively as a silly and fun place where her colleagues were also her good friends. She asked girls about their career interests and offered one to introduce one girl who wanted to be an auto mechanic to her friend who designs engines for cars. She wrapped up by encouraging girls to enter science careers: “First of all, you are the future. I want you to think about if you want to be in science and do science. You can make a world of difference.”

A site that had their first role model visit in-person and then a virtual visit by a second role model compared the two and concluded that they were both positive experiences: “In-person always more personable; it allows the self to be more spontaneous, but they both walked away being introduced to a new career path or being connected. The foundation of why you do those mentor moments was fulfilled in both. At the end of the day they were both good.”

An educator who had two virtual site visits expressed her desire to have someone to come in-person to their site. Since she couldn’t find a professional woman working in CS nearby, they did a field trip to a local university to visit the computer science department. Two female students met with them and showed the projects they were working on.

One role model who visited a program during MobileApps was an app designer, working with cities to bring ticketing for public transit. The educator said, “She was doing exactly what the girls were learning how to do.”
ROLE MODELS

4. To what extent do role models have increased knowledge of how to reach out to girls and increased confidence in their ability to effectively be a role model?

5. To what extent do role models utilize effective strategies from the training in conducting outreach?

6. What other impacts do role models experience as a result of their participation and training?

Key Findings

- Most role models felt their experience as a role model was worthwhile, but their understanding of how to engage girls in computer science and their confidence conducting outreach had room for improvement.
- Role models were likely to use effective practices to engage girls during their role model visits, including describing their job in understandable terms and making connections between their job and girls’ everyday lives. Role models led hands-on activities a little more than half of the time.
- Over 70% of role models indicated they shared their educational or career path and how they chose to work in their field “A lot.”
- Educators indicated role models utilized positive messaging with the girls.

Most role models felt their experience as a role model was worthwhile and that they would seek additional outreach opportunities. Mean responses for role models’ understanding of how to engage girls in computer science and their confidence conducting outreach were lower, but overall at least 86% agreed at least a little with each statement. Only 14% of role models strongly agreed they were more confident conducting outreach and better understood how to engage girls in CS.
Most role models felt their experience as a role model was worthwhile, but their understanding of how to engage girls in computer science and their confidence conducting outreach had room for improvement. *(n=14)*

No respondents selected “strongly disagree.”

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Disagree a little</th>
<th>Agree a little</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>21%</td>
<td>21%</td>
<td>43%</td>
<td>14%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Disagree a little</th>
<th>Agree a little</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>14%</td>
<td>36%</td>
<td>36%</td>
<td>14%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Disagree a little</th>
<th>Agree a little</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>7%</td>
<td>21%</td>
<td>29%</td>
<td>43%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Disagree a little</th>
<th>Agree a little</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>7%</td>
<td>7%</td>
<td>36%</td>
<td>50%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Role Model Reflection Survey

Role models frequently encouraged girls to ask questions during their visits. They also shared how they decided to work in their chosen fields and their educational and career paths. Nearly half (46%) of the role models did not facilitate any hands-on activities with the girls. Just shy of two thirds (64%) of the role models shared that the coding/computer science content or activity covered during their visits was slightly related to their own work or area of expertise. Half strongly agree that they will reach out about additional role model opportunities, and another 43% agree or agree a little that they will reach out.

**Role models encouraged girls to ask questions as part of their role model visits.** *(n=14, unless noted)*

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>Yes, a lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>71%</td>
<td>29%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>Yes, a lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>29%</td>
<td>71%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>Yes, a lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>8%</td>
<td>15%</td>
<td>77%</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>Yes, a lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>57%</td>
<td>43%</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>Yes, a lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>58%</td>
<td>42%</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>Yes, a lot</th>
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</thead>
<tbody>
<tr>
<td>21%</td>
<td>79%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>Yes, a lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>46%</td>
<td>23%</td>
<td>31%</td>
</tr>
</tbody>
</table>

Source: Role Model Reflection Survey
Educators indicated on post-strand surveys whether they thought role models used specific strategies during their visits. Across all three strands, educators most often indicated role models utilized positive messaging with the girls. Educators indicated that role models were not very likely to have followed-up and provided feedback on their role model experience.

According to educators, role models most consistently utilized positive messaging and least consistently followed-up and invited feedback.

<table>
<thead>
<tr>
<th>Role models utilized positive messaging</th>
<th>Mobile apps (n=20)</th>
<th>Robotics (n=18)</th>
<th>E-textiles (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90%</td>
<td>78%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Role models followed-up and provided feedback</th>
<th>Mobile apps (n=20)</th>
<th>Robotics (n=18)</th>
<th>E-textiles (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10%</td>
<td>39%</td>
<td>43%</td>
</tr>
</tbody>
</table>

*Source: Post-strand surveys*
During a site visit observation of a role model visit, the role model incorporated all effective practices shared during the SciGirls Code training, even though she did not attend or access the training sessions.

- I shared personal information about myself with the girls such as my hobbies or what I liked at their age.
- I shared my educational or career path with the girls.
- I shared about how I decided to work in my chosen field.
- I described my job in a way the girls could understand.
- I was able to make connections between my job and the girls’ everyday lives.
- I encouraged the girls to ask me questions.
- I facilitated a hands-on activity with the girls. Note: She assisted in the planned activity of the session.

She started by showing girls a video of her company, which created fashionable “wearable” technology, such as a smart watch or ring. She asked girls what a wearable was (they responded, “shoes” “clothes” “earrings”). She told them it was jewelry and that “We are in the midst of a fashion revolution—the collision of fashion and technology. We want to wear them and look amazing. Putting engineers and designers together to make things.”

She shared examples of ideas for a similar company coming from the realization that many women like things fashionable and they would rather keep their phone in their bag instead of carrying it. “Wearables,” like pendants, rings, and necklaces can tell them information (such as text messages or who is calling) so they do not have to constantly check their phone. Her background is app development and she thought, “What if we can move a picture from your smart phone? You can get a personalized image reminder and a vibration on your watch as a notification. When that rose comes up, that means my mom is calling. Most of the time you have your phone in your pocket or purse. You can’t tell if somebody was calling. You can’t feel it. That was the problem, this is my solution.”

She paused many times for girls’ questions. One girl wanted to know if it was before the Apple watch and another wanted to know if you could talk to people on the watch. Another asked how much it costs. The role model explained that it doesn’t have a microphone because that would make it bigger, and that they are still looking for funding, but once they have investors and a market, “we can make that happen.”

The role model transitioned to talk more about science. “We’re talking about science. We’re talking about you. Today, you are touching components; thinking about what you want to do. Thinking about what you want to do in the future.”
The role model had a similar background of many of the participants. She told the girls she is Latina and from a modest family in San Bernardino who did not know what she wanted to do. She told them about realizing that she was first on the Dean’s list and that she had no idea she was a good student until that moment:

“I go to look and I see my name. First? How come I didn’t know I was on the Dean’s list? How come I didn’t know I was getting good grades? That I can make it? I thought about it. I like school, I like to learn. I want to better my life. I want to make money in the future. Who doesn’t? raise your hand if you don’t. I want to have a fam and have weekends off and travel and learn. So I studied and went to school and I went to university and went into fine medical engineering because I wanted to help people. But life took me to electrical engineering and I’m so glad.”

To help anyone succeed, she felt that at least one supportive person was necessary, and she shared that with the girls:

“There was one person. If you have one person, a mother or friend. If you have one, you can make it. I had this one person. She was from a community college. She said, ‘What do you want to do?’ I said ‘engineering.’ She said ‘good.’ There was no fear. She said ‘You have potential.’”

The role model shared that she was the only girl in her engineering classes. She talked more about the nature of work of engineering:

“Some people can tap dance and sign at the same time, but these engineers are so specialized, you have to hire a team. What we have here. Who designed this? Mechanical! Right. Mechanical that designs engines. Mechanical engineers design this. It’s done in software. Also software engineers. You hire the right people. Because my background is in engineering, I know how to hire the right people.”

She shared information about her work that the kids were really interested in, such as that she had traveled to Paris. She also showed a video of e-fashion shows and tells them that they still do these runway shows and gives prizes for the best tech design.

Finally, she gave the girls lots of positive encouragement: “You guys have potential. Nobody knew I had potential. I didn’t know until I saw myself on the dean’s list. You guys have it.” She left the girls her email address and told them to write her for advice.
YOUTH PARTICIPANTS

7. Who are the girls reached by the trained educators?

Key Findings

★ Of 108 SciGirls Code participants who indicated their race/ethnicity on the post-survey, 58% indicated they were Caucasian/White. About a third (32%) spoke a language other than English at home.
★ Girls joined for a variety of reasons including being recruited, parent influence and wanting to do coding.
★ Some girls left the program because it was too easy or they did not mesh with other girls.

Of 108 SciGirls Code participants who indicated their race/ethnicity on the post-survey, 58% indicated they were Caucasian/White. About a third (32%) spoke a language other than English at home.

**Fifty-eight percent of SciGirls Code participants were Caucasian/White and 21% were Hispanic/Latina (n = 108). Participants selected all categories that applied.**

```
Caucasian/White          58%
Hispanic/Latina/Mexian/Mexican American  21%
African American         16%
Asian American           13%
Native Hawaiian/Pacific Islander  4%
American Indian          8%
Other                    10%
```

*Source: Participant Post-Survey*

Educators shared how they recruited girls to the program: During one site visit, the educators said that “recruitment was super easy” as most had done programs with their organization in the past, including a summer robotics program that was popular with the girls and their parents. Several educators knew the girls with whom they worked, and being familiar with the girls worked well since educators knew they had the girls’ buy-in and that they would attend: “For the most part, they showed up and they were super chill. They feel comfortable; they know the place. That made it easier for us.”
Girls indicated they signed up for the program because of parent influence: “I hoped to learn a little more on computer tech. Because my parents are really into it. My dad owns business and my mom works at this school.” Many girls had previous experience coding and wanted to do more coding through the SciGirls program: “We were interested in coding and wanted to learn more about it.” Girls also had a similar programmatic experience in the past: “I signed up because during the summer, I did an engineering robotics thing here. They told us there was SciGirls Code and we’d work with other girls.”

Looking at attendance patterns, educators noticed two different patterns for who stopped attending SciGirls Code. In one example, girls who were more advanced dropped because they were off-put by the easiness at the beginning of the program. The girls dropped despite messaging from the educator that they would be challenged in later parts of the program. At another site, the older girls stopped coming as most other girls were younger and already friends.

“One thing about the program is that it was so geared for entry level girls, we had girls in the beginning who had lots of experience, but they dropped out right as it was getting interesting. We were like, ‘but this is the part where it gets creative,’ but they dropped and never came back.”

Educator
### YOUTH PARTICIPANTS

#### 8. How do girls participate in SciGirls Code?

<table>
<thead>
<tr>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>★ On average, between three and 12 girls attended each session.</td>
</tr>
<tr>
<td>★ Girls who did not attend the program regularly dropped out or missed sessions due to afterschool programs, transportation issues, or loss of interest.</td>
</tr>
<tr>
<td>★ Twenty-seven percent of girl respondents (out of 108) experienced a role model visit.</td>
</tr>
<tr>
<td>★ Girls who experienced Flipgrid used it to get to know each other and create a sense of community across the program.</td>
</tr>
<tr>
<td>★ Girls enjoyed the SciGirls Code program, working through challenges and learning about teamwork.</td>
</tr>
</tbody>
</table>

"The program was overall a huge success. The girls learned not only about coding but so many other skills like collaboration, communication, critical thinking, problem solving, debugging, and so much more. I have parents contacting me asking if we are going to do the program next year so their child can join. The girls have a confidence now that they didn't have before when they try to do something because out of everything the program promoted perseverance and I saw that in spades towards the end."

*Educator Reflection Survey*

Between three and 12 girls, on average, attended each SciGirls activity. Girls had varying degrees of experience with role models and Flipgrid. Ultimately, girls enjoyed the program as documented through girl focus groups and the testimony of educators.

Attendance typically decreased over the course of the year. At a site visit, girls explained how the program had dwindled to fewer than 10 participants due to a competing afterschool art program that started in the second semester of school, pick-up or transportation issues, having a friend stop the program, or losing interest in the content.
Seven sites had an average of at least 10 girls attending each session.

![Bar chart showing the number of girls attending the final sessions at various sites.]

Source: Attendance Sheets (note: Salem Keizer records were incomplete)

Role model visits

Of 108 SciGirls Code participants completing the post-survey administered by the research team, 22% had not experienced a role model visit in-person or online (via live video) during their program. Twenty-seven percent of respondents had a role model visit both in-person and online. In total, 63% of girls experienced a role model visit in-person and 44% had experienced a role model visit online.

In addition, almost half of girls (48%) watched Flipgrid role model videos online (and another 22% were “unsure”), including six girls who did not otherwise have a SciGirls Code role model visit.

Connected Learning

Girls used Flipgrid to get to know each other and create a sense of community across the program. They also used Flipgrid to ask each other questions and share their projects.

The grids for SciGirls participants had 13 topics and a total of 8,277 views across those topics (including the role model video series). Topics included a space to share issues or ideas on each strand and demonstrations of the makeathon products for each strand. The most viewed topic were the 193 videos under the prompt, “A Minute of Me,” which was the first prompt for girls starting in SciGirls Code (available in August 2017). There were a total of 193 response videos and a total of 3,855 views throughout the year.
Overall experience of the girls

“[This program has inspired me to, made me become interested in pursuing a career in coding. Before this program I didn’t really have anything in mind, but now I want to be a code or engineer.”

*SciGirls Code Participant*

Girls in focus groups conducted during site visits talked about really enjoying the *SciGirls* Code program. Girls in particular enjoyed making apps and programming and robotics: “I think the best was doing art robot. That was really, really fun. Everybody was stressing out sometimes, but then it was fun. It was hard and then there is a reward.” Additionally, girls enjoyed building relationships with other girls, engaging in problem solving and overcoming challenges. They talked about how they worked through challenges: “The teachers wanted us to figure everything out but sometimes it’s a little frustrating when you can’t figure something out. But we got over it and ended up coding our sensor.” Another girl said, “I don’t really like the software stuff, I just needed a lot more time to actually figure something out.” This program was also a source of inspiration for some girls. Girls talked about their awareness of coding as a career and also talked about how this program contributed to their affinity to technology. Educators agreed that girls gained confidence and coding skills.
9. How are girls affected by role models? How is the impact of role models related to how girls connect or interact with role models?

Key Findings

★ Girls were positively affected by role models. Role models showed the girls that people like them could work in CS.
★ Girls found role models to be inspiring and role models made girls more interested in working in CS.
★ Educators generally thought role models had a positive impact on girls, though there were some educators who thought the role models did not significantly influence the girls.

Girls rated the impact of role models on them positively, with 91% of participant post-survey respondents indicating that SciGirls Code role models showed them that people like themselves can work in CS. Eighty-six percent of girls indicated they better understand what computer scientists do because of their role models (and nobody disagreed). The role models were inspiring to most girls (72% agreed or strongly agreed) and made the girls more interested in working in CS (64% agreed or strongly agreed).

Role models impacted most girls in a variety of ways, and especially in their belief that people like themselves can work in computer science.

Because of SciGirls Code role models...

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>No opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>...I think that people like me can work in computer science. (n=95)</td>
<td>2%</td>
<td>7%</td>
<td>39%</td>
<td>52%</td>
<td></td>
</tr>
<tr>
<td>...I better understand what computer scientists do. (n=96)</td>
<td>14%</td>
<td>35%</td>
<td>51%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...I feel inspired. (n=95)</td>
<td>4%</td>
<td>21%</td>
<td>24%</td>
<td>48%</td>
<td></td>
</tr>
<tr>
<td>...I am more interested in working in computer science. (n=94)</td>
<td>3%</td>
<td>30%</td>
<td>31%</td>
<td>33%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Participant Post-Survey

Girls shared more detail on how they were affected by role models in response to an open-ended question on whether a role model changed what they think, felt or might do. Thirty-five girls responded...
that role models did not affect them. However, for many of those respondents, they were already interested in computer science, for example:

- “To be honest, no, because I have high goals and they have high goals so I didn’t change anything.”
- “Not really, I’d say they have reinforced it since I already love inventing & coding, etc.”

Role models helped girls learn about computer science and careers in the field and gave them an understanding of what they could do:

- “At first I wasn’t really sure how a computer science job would look in real life but after we talked with the role model I got a better idea of it.”
- “I felt like they taught me stuff I didn’t know about computer science.”
- “I think that they made me more intrigued about computer science.”
- “They made it [computer science] more exciting . . .”

Girls felt encouraged to overcome computer science or coding challenges that they have or might have experienced:

- “The SciGirls role model helped me think that what I was doing was possible even when it was really hard and I thought it wasn’t possible.”
- “They definitely changed the way I reacted whenever I had a miscommunication or failure with a project that I was either working on by myself or with another group of girls.”

Girls also felt inspired to overcome challenges that they have or might have experienced related to females being underrepresented in computer science: “Yes, because it showed me that just because you might be the only female in your class at college or the only friend that is interested in computer science doesn’t mean that I should give up.”

Others mentioned more general inspiration and encouragement:

- “Yes, because they made me know that I could do it by myself.”
- “The role model encouraged us to keep trying which inspired me to keep going.”
- “The SciGirls role model helped me think that what I was doing was possible even when it was really hard and I thought it wasn’t possible.”
- “Yes, they made me feel more inspired and more interested into jobs that involve STEM.”

Girls indicated that role models encouraged them to persist in the face of challenges very frequently (60% indicated “All the time” or and 28% said “Most of the time”). The role models were also very likely to answer girls’ questions, help them with activities, and share what they liked about CS (at least 80% indicated “All the time” or “Most of the time”). At least half of girls experienced role models who shared personal information, used hands-on activities and found similarities with girls during most of the visits.
Most girls indicated their role models used effective practices for engaging girls all of the time or most of the time; they especially encouraged girls to keep trying.

<table>
<thead>
<tr>
<th>Role Model Activity</th>
<th>Not at all</th>
<th>Some of the time</th>
<th>Most of the time</th>
<th>All the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>The role model encouraged me and other girls to keep trying even when things were</td>
<td>12%</td>
<td>28%</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>challenging or if we made mistakes. (n=92)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The role model took time to answer my questions. (n=89)</td>
<td>4%</td>
<td>10%</td>
<td>31%</td>
<td>54%</td>
</tr>
<tr>
<td>The role model helped us do SciGirls Code (answered questions, made suggestions).</td>
<td>4%</td>
<td>14%</td>
<td>31%</td>
<td>50%</td>
</tr>
<tr>
<td>(n=90)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The role model shared what they really liked to do or what they were interested in</td>
<td>1%</td>
<td>18%</td>
<td>31%</td>
<td>49%</td>
</tr>
<tr>
<td>about computer science. (n=93)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The role model shared a personal story or facts about themselves. (n=83)</td>
<td>6%</td>
<td>39%</td>
<td>22%</td>
<td>34%</td>
</tr>
<tr>
<td>The role model used hands-on activities (not activities where I sat and listened to</td>
<td>26%</td>
<td>18%</td>
<td>31%</td>
<td>25%</td>
</tr>
<tr>
<td>them talk). (n=77)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The role model found similarities or made a connection with me or other girls. (n=84)</td>
<td>5%</td>
<td>33%</td>
<td>36%</td>
<td>26%</td>
</tr>
</tbody>
</table>

Source: Participant Post-Survey

Girls were asked to identify the best part of having role models visit their program (in-person or online). They mentioned learning about computer science and computer science careers, feeling inspired, getting their assistance with activities and realizing shared experiences or struggles. They also mentioned getting to know the role models and having the opportunity to ask them questions.
### Best part of having a role model

Open-ended responses from participants

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples of Girls’ Responses</th>
</tr>
</thead>
</table>
| **Learning about computer science/careers** | • “The best part about having role models was being able to ask them questions about jobs in the computer science field that our teacher/proctor couldn’t answer.”  
• “I got to learn a lot about the types of computer sciences and learn how they work like game designing and web site designing.”  
• “I think the best part of having role models come was that when they came they taught me more things about computer programing.”  
• “Showed me how I could apply what I’m learning in real life.”  
• “They told us more about computer science, and they encourage us, to have fun.”                                                                                                                                 |
| **Feeling inspired**              | • “The best part was knowing that you have to work hard to be like a role model, and you know you can work that hard.”  
• “You have a goal to get as good or better than them.”  
• “They really inspire me. They told us how they started and how they grew their company and how it works. I really appreciated them coming in to encourage us girls.”  
• “Best part having a role model was knowing that females are just as strong as men.”                                                                                                                                 |
| **Realizing shared experiences/Struggles** | • “It makes you feel connected there are other people having the same mistakes you are.”  
• “Having someone to understand what you’re going through and praising you for what you are able to do at such a young age that they only learned a few years ago.”  
• “They tell you that it’s okay to have problems because they have problems too. They reassure you.”                                                                                                                                 |
| **Getting to know the role model (personally)** | • “We got to ask them questions on Skype and we got to see what they looked like and what they liked to do in their everyday life outside of computer science.”  
• “Gettin to hear their story.”                                                                                                                                                                                                 |
| **Getting their help on activities** | • “They could check over your work and help you correct or make it better.”  
• “It was very fun to hear their opinions and what they know or how they could help fix the issue us girls are having with computer programming.”  
• “They got to help us further understand coding and they helped us with everything we didn’t understand.”  
• “They were able to help us work through difficult code.”                                                                                                                                 |

*Source: Participant Post-Survey*
Educators felt that girls were affected by role models through the exposure to careers, feeling inspired and supported, gaining confidence, and making personal connections with them. Through the role models, girls met a woman working in CS and heard about their careers. An educator felt this exposure would allow girls to see the options available to them for working in CS, “I believe it gave them a chance to see real women using what they were learning about to go to college or have a career in. This let them know that there are lots of opportunities out there for them and they can do it if they want to.”

One educator felt it really pushed home the point that women work in CS:

“"I think that the girls were affected by role models, simply in working and talking in-person with a woman who has a real world job in computer science. It was a very real statement that there are women working in coding careers- a lightbulb moment of ‘oh, wait, they're not just telling us about this, it's actually a real thing.”

When the role models assisted the girls in activities and encouraged them to solve problems, educators felt the girls were more motivated.

Girls gained from the energy of somebody new visiting their program, especially when they were charismatic and engaging:

“The girls very much enjoy interacting with role models! Our app design role model was particularly great - she was very dynamic, shared some really interesting examples with the girls, and she brought app design challenge cards from her business that the girls could play with. I wish we'd been able to schedule more role model visits!”

In the Educator Reflection survey, six educators were not sure the role models were having a large impact on the girls, mostly due to the short time of the visits.

- “I am not sure. I think in the moment they were, but down the line I think they forgot the importance.”
- “When we were able to incorporate them, they had a moderate impact. The girls did interact with them, but the strands felt rushed not leaving time for a more robust connection between role models and the girls.”

In two other responses, educators mentioned they did not have as many role models visit the program as they would have liked. Finally, one of the educators felt that younger role models may have been easier for girls to connect with.
**SCALE-UP**

10. What was learned during implementation of this model that could inform future scale-up?

**Key Findings**

★ The project team was attentive to the efficiency and effectiveness of all different aspects of the project model to help guide future scale efforts. Ideas captured here include:

- Making training content accessible online.
- Adding new strands and modularizing the existing curriculum and allowing sites to choose specific curricular strands to implement.
- Strengthening the use of Flipgrid.
- Having sites to apply for funding for materials and resource instead of providing all sites with all materials.

As a pilot project, the SciGirls Code team wanted to learn as much as possible. This effort was aided by all 16 sites completing the project and participating in the evaluation and research components. Based on their experiences, and knowledge of the data collected to date, the project team has considered the following items in future scale-up efforts:

- Making content and activities from the in-person training available in an online learning format.
- Breaking the 9-month curriculum into smaller chunks to make it easier for partner sites and other organizations to merge the content and activities into existing informal STEM programs.
- Adding new strands like cybersecurity or game design, and making these strands available to existing and new partners.

**Technology Tools**

- The project team is considering how to strengthen the use Flipgrid, which connected girls across sites to each other. They found that girls appreciated responses posted from other educators as it gave them a wider audience and support of their work. The project team could comment on videos or ask educators to make it a routine to do so.
- The project used the LRNG platform with educators at the beginning of the project and found it was not a good fit. Flipgrid was a great solution to their needs and worked well, but having Flipgrid from the beginning would have made for a cleaner adoption by the sites, who had to struggle with LRNG then transition and learn something new partway through the project.

**Equipment and Materials**

- The project team collectively wondered if instead of giving everybody equipment and materials by default, if it might work better to have partner sites apply for funding for what they need.
Many programs already had laptops or tablets they used or could have used (for example, school-based sites utilized readily available laptops and computers). By purchasing and owning their own equipment, it might be clearer to educators that they are responsible for caring for and maintaining that equipment.

- There is a need for activities and content with low equipment needs and/or low recurring cost. The E-textiles strand may be challenging to scale-up, as the materials were consumable, not common, and may be difficult to obtain. However, the project team believes that if the curriculum strand was proven effective by the evaluation and research teams, then it would be possible to find alternative funding sources to allow others to implement the strand.
- To help prevent tech support being too burdensome for Twin Cities PBS, they were looking into using equipment from Best Buy Education, since they would provide technical support out in the field.

**Management**

- Twin Cities PBS had a larger number of staff working on this project compared to others, which made it easy to divide and share responsibilities.
- To make it easier for educators, Twin Cities PBS had designated one staff person as the first point of contact for educators. There was continuity for educators and they always knew who to go to with questions.

Educators from the winter and spring interviews thought a school environment was a good site to host the program: “Kids could share what they were doing [in SciGirls Code] with their teachers. It’s been nice to have it here.”

**SCALE-UP**

11. What were benefits and barriers of participating for educators and their organizations?

**Key Findings**

- Benefits included increased confidence and skills in girls, learning about a high-quality CS program, and the resources gained from participating in the project.
- Barriers included time, such as the amount of time educators needed to plan and implement, girls’ scheduling conflicts, and time to complete the activities.

**Benefits**

Educators most commonly named benefits to their girls, a high-quality CS curriculum, and the physical materials that resulted of their participation in SciGirls Code.
**Benefits to their girls** as a result of their participation in *SciGirls Code*, girls expanded their 21st Century skills, knowledge and confidence. One educator said, “They harvested a knowledge and confidence for computer science which wasn’t there for many of them before... The most important thing was that they gained a respect and confidence for the field they may not have had previously.” Girls benefited from the exposure to computer science content and careers and from being in an all-girls program with other girls like them.

**A CS Program/Curriculum:** As organizations that have already been involved with past efforts of *SciGirls*, there was already a high commitment to the mission of the program and to engaging more girls in STEM through informal education opportunities. Additionally, many of the partners had expressed interest in getting involved in Computer Science or coding and therefore the opportunity of *SciGirls* Code was especially appealing (according to Project Team members).

Educators described benefits of their exposure to the program:

- “Scaffolding of a complete, up-to-date/current curriculum.”
- “The program was fantastic and really engaging. I felt like the access to innovative materials and the curriculum was completely worth it. We never would have been able to access that, and now we have a gateway into continuing and developing it further.”
- “It’s been nice to have a full curriculum that’s been developed and tested, because we’re trying to get more girls into our computer classes. It’s something we’ve struggled with. It’s been a nice way to diversify the classes that we’re offering.”

**A Learning Experience:** The lessons learned while implementing a new program and curriculum provided useful information for educators and their organizations, such as what it felt like to recruit all-girls and to do a program requiring an extensive time commitment, (both in meeting time per week and 9-month commitment). Partner sites can base decisions of future programming on what went well for them, what was challenging, and what they could do differently to improve: “Now we know as a program, if we’re going to execute this, afterschool during school day program as our model, we now know what we need to do to make it work.” Another response named the lessons they learned about how to engage girls in CS: “This curriculum taught me a lot about how to facilitate computer science concepts with our girls. I plan on using these skills and them lessons in camps and after school programs going forward. I am actually in process of updating our Robotics curriculum based on this experience.”

**Effective Practices:** The professional development provided to educators focused on effective strategies to engage girls in STEM and CS, mostly through the SciGirls Seven. These lessons and the positive
experiences in applying the practices offered long-lasting benefits that educators could apply to other programs and future work, including the use of role models and how to integrate design aspects into projects:

- “The emphasis on role models has helped us think about how we can do more to integrate STEM professionals into our informal STEM programming as guest speakers and role models; we have already done that more frequently this summer than we had done in previous years, so that's been a big benefit.”
- “One of the things I learned is how important it is the crafting side. I’m not much of a creator, so now I will bring a box of making junk wherever I go, and I’ve really learned that from you guys and that has helped me to be a better girls camp runner. All of that stuff I’ve never really thought about (crafts).”

Educator Knowledge, Skills and Confidence: Educators received professional development for two people per site. Professional develop covered an introduction to the curriculum, exposure to new CS skills and how to build computational thinking skills with girls and themselves, effective practices to engage girls and more on how to successfully implement the program. All of these components were embedded in in-person training and educators stated that they gained a lot of confidence and knowledge as a result of this training and experience implementing:

- “I know a lot more about apps, robots, and E-textiles for sure.”
- “I gained a lot of confidence as an instructor.”

Learning Community: Educators had a strong learning community, due at least in part by the project team’s efforts to bring educators together to serve as a resource for each other and share best practices and challenges. The monthly webinars, use of LRNG and then Flipgrid and the Google Groups listserv all helped connect educators together and encourage sharing and collaboration. “Creating connections with area schools and coding professionals. Along with the community of other educators around the country interested in engaging girls in CS.”

Materials and Equipment: Partner sites were able to keep all of the equipment they received as part of their involvement (as long as they have plans to use it), which was a large financial benefit of educators’ participation in SciGirls Code. These responses typically also mentioned the importance of the curriculum to go with the materials:

- “We got more great physical coding resources and curriculum for our school, that we can use to do SciGirls next year as an afterschool class.”
- “The program was fantastic and really engaging. I felt like the access to innovative materials and the curriculum was completely worth it. We never would have been able to access that, and now we have a gateway into continuing and developing it further.”
Getting to Know and Inspiring Participants: Building a relationship and having a trained cohort of girls to engage in upcoming programs: “In the future, I hope that we will benefit from the relationships with the girls that we met by encouraging them to be ambassadors for other coding projects.”

A Reputation and Public Awareness of their organization’s CS: “An excitement building wide to continue to grow our coding program...after school classes.”

Barriers/Challenges

A lack of time to complete all aspects of the program was the number one challenge to participating, according to educators. Conflicting commitments of the girls and keeping girls engaged were other main challenges faced by educators.

Time to Complete all Activities: Educators constantly felt time pressure to make it through all of the curriculum strand activities as well as implement the other components of the program. As educators wrote:

- “Time!!! - Time for role models - Time for Flipgrid - Time to view SciGirls episodes - Time for brain breaks - Time for celebrations - Time for makeathons - Time for family participation”
- “Not enough time for the girls to finish projects, so we felt rushed.”

Another educator explained how they got behind partly due to time spent on Flipgrid, activities taking longer than planned, and catching girls up after absences:

“While 3 hours is a lot of time in the week we would still get behind in the schedule because we were doing Flipgrid, video shorts or it was just taking them a little longer than expected. When the girls would miss a session it put their group behind or them behind and trying to catch them up on what they missed was sometimes challenging but it is hard for people to commit to three hours after school a week for the whole school year.”

For another site, the challenge was associated with the scheduling of the school where they were holding the program: “We had a lot of issues with meeting the hours required because the school we worked with had a lot of other commitments/programs and they kept changing the calendar on us last minute.”

Program Length (9-months): One educator mentioned that they had to carefully consider whether they could successfully implement a program of this duration: “Nine months of weekly 3-hour programing gave us pause. We are an institution that does not serve girls in this sort of sustained and regular way, so we have had to consider very carefully the access points we have to a steady population of girls who can...”
participate.” The time commitment was difficult for the instructor at some sites, especially if they had other conflicting job responsibilities.

**Maintaining Attendance:** Programs were supposed to engage ten girls for nine months. However, there is strong competition for middle schoolers’ time, so it was difficult for them to commit to SciGirls for so long. An educator felt that more flexibility in how the girls were able to participate would have been helpful. “Afterschool there’s lots of competition for kids’ time, but also really hard to run a highly academic program after school because the girls are wiped out.”

**Materials/Technology issues:** Only two educators mentioned technology related issues as a “top challenge” in the Reflection survey. One mentioned challenges accessing YouTube videos at their site and another had more girls at the beginning of the year and not enough materials to go around.

**Educators’ Time:** Project team members reiterated some of the same barriers, such as for educators to fit this work in with their other job responsibilities and also to juggle all of the different responsibilities of their role: participating in evaluation and research activities, recruiting girls, using LRNG and Flipgrid as well as all of the technology for the curriculum: “It took a lot of time to learn the components I was less familiar with. There were times when I did not have that time give due to other aspects of my job, I feel that though I know the girls loved the projects they were doing, they did not always get the full STEM experience that I wanted them to have.”

**New Educators/Role Shifts:** An additional challenge was that some sites added new educators to their implementation team in the summer before the program implementation. Those educators did not have the opportunity to spend a few months getting acquainted with the program or attend the in-person training (though they can access the webinar recordings).

**Partner Challenges:** Some sites experienced challenges related to working with partners to offer SciGirls Code (such as partnering with a school to hold the program there as an afterschool program), including logistics, technical issues, and scheduling challenges. One partner site was resistant to having an all-girls program and they ended up offering a separate club for boys.

**Keeping Girls Engaged:** This was especially an issue for programs that held longer sessions. This challenge was associated with the struggle to complete the curriculum, as educators were constantly trying to keep them moving through the activities.

- “We also had a lot of girls with short attention spans which was not helpful since we had limited time to begin with.”
- “It was hard at times to keep the girls motivated for 3 hour stretches.”
- “We lost girls to ‘too easy curriculum’ and other afterschool activities. It was also challenging to do a program like this after school - the girls were wiped out after a long day of classes. Lots of snacks were needed to keep them going!”

Despite the challenges associated with participating, none of the 16 partner sites dropped out. They all finished, though with different levels of fidelity depending on various challenges. Many educators
planned to continue SciGirls Code activities in out of school programming, after school and/or during the summer. A few educators shared that the activities would be shared with other sites and a few said they would incorporate the activities in to their school day.

**Examples of How Sites Will Continue SciGirls Code**

<table>
<thead>
<tr>
<th>Short Description</th>
<th>Educator Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer camps and classes on apps and e-textiles</td>
<td>&quot;We are already continuing SciGirls Code at [site]! We have modified the curriculum units into separate summer camps and are offering app design and e-textiles classes for girls this summer. Both work very well as a week-long summer camp!&quot;</td>
</tr>
<tr>
<td>Summer coding and robotics</td>
<td>&quot;We have also already been using it this summer with our coding and robotics class in our [site] program. We will definitely make sure we meet with them more than once a week to ensure they receive all of the curriculum. We will use all of the equipment until it breaks because we have a strong STEM focus in all of our programs.”</td>
</tr>
<tr>
<td>Afterschool next fall</td>
<td>&quot;We will continue this in the fall at the same school. The school has made the commitment to add it as an afterschool program and pay the teacher’s salary for her time. They will also purchase consumables we used up. [Our site] will provide the hard equipment, Spheros, tablets, etc.”</td>
</tr>
<tr>
<td>Same program next year</td>
<td>&quot;We’d love to continue with SciGirls next year. We are going to use the same curriculum and as much of the materials as we can (the ones that we can use again).”</td>
</tr>
<tr>
<td>As a school day class</td>
<td>“I am working with my admin to possibly offer SciGirls Code as a class for middle school girls next year during the school day. This would mean more time and buy in from students since it will be one of their classes. We might have to adjust some of the activities due to equipment but I think that it will be a great way to create a safe and fun environment for girls to experience computer science.”</td>
</tr>
<tr>
<td>In a new non-profit</td>
<td>“I have stopped working for [site], and have started a non-profit aimed at teaching coding to women and girls. I have been heavily influenced by the training and curriculum from SciGirls. I just ran 2 2-week camps for HS and middle school girls at [university]. I use different platforms/tech for my teaching, but I follow many of the core SciGirls Seven in my teachings. I believe [my site] ran an app camp for girls this summer using this curriculum.”</td>
</tr>
</tbody>
</table>

Source: Educator Reflection Survey
20. How could the project more effectively and/or efficiently meet its outcomes?

Key Findings

- Educators could have used more flexibility in the timeline for implementing the curriculum.
- Deeper ongoing training opportunities during the implementation period could have been helpful.
- Making sure the Flipgrid and role model components are well-used by every site could increase their impact.

Three educators suggested that SciGirls Code allow more flexibility with implementation which would allow them time for girls to problem solve. One educator wrote that the strands should be split to stand on their own so they could spend more time on one topic.

While most educators praised the training and support of the program, the project team wondered if a training closer to when educators would be implementing the program would be more effective (the in-person training was held about five months prior to when sites starting their programs). With one in-person training, the team struggled with the balance of covering all of the content of the project and not being too long considering time and cost. One team member commented that, ideally, the training would be four to six days to cover the curriculum, but that it would be unaffordable.

The educator professional development could include more focus on how to facilitate the computer science activities, engaging girls and building computational thinking skills by modeling the strategies they expected the educators to use with their girls. Debriefing the pedagogical aspects of a lesson could help educators think through the best way to lead activities. One educator suggested at least one more webinar focused on effective strategies to work with middle school girls.

A blended professional development program that provided educators options for in-person and online participation may help educators with scheduling limitations access training and resources when needed and make it less time consuming for the project team to provide ongoing support.
Four educators requested more ongoing support, including with tech support, more individualized support (rather than whole group webinars, and more informative webinars, such as showing the activities: “Any training videos for the more difficult parts of the curriculum would be helpful.” How-to videos, even for the girls, could have also helped:

“Overall, great stuff! Biggest thing is having more accessible How-to's for the actual coding lessons/activities. [My co-educator]and I found ourselves having to regurgitate to simplify the coding activities for AppInventor, ArduBlock and especially Arduino (which is hard for adults who are not in the CS career field). Maybe embed some more How-to videos and visuals for girls and teachers. Maybe cut down on some of the easier activities so to have enough or more time for the actually coding since that was always the hardest for the girls.”

Better incorporating the role model component into the curriculum or program activities could make it more likely educators would see it as a critical piece rather than something extra that could be skipped if there was not time. Identifying a time in the curriculum when a role model could come in and lead a suggested activity may help those who needed more structure or time.

Additionally, project team members would like to use Flipgrid from the beginning of the project and showcase, early on in a webinar or at the training, how to access role models videos on Flipgrid and have girls post comments.

The episodes of SciGirls was not a popular component of the program. Educators frequently cut them due to time constraints, but also because their girls were not highly engaged by them: “Watching the videos has been painful. The cartoon aspect totally turns off the middle school girls.”

**SCALE-UP**

21. What components of the project were most crucial to its success?

**Key Findings**
- Components of success included the training, curriculum and makeathons, relationship building, and Connected Learning.

Aspects of the project that helped lead to a successful implementation included:

- **The curriculum**: Educators shared that the most crucial aspects of the program in determining the success of SciGirls Code at their sites were the curriculum and associated activities: “The curriculum was age appropriate therefore the girls could experience success. It was those successes that motivated them to move on to the next activity. They relished accomplishing tasks that they have never done before like creating a mobile app, wiring a creation with the Humming Bird PLC, completing a circuit and seeing the LEDs light up, and understanding and controlling inputs and
outputs. They had so much to be proud of.” Educators commented that the curriculum was age-appropriate, hands-on, and engaging to the girls.

✓ The makeathon at the completion of each strand required that girls put their new knowledge and skills to the test. The makeathon mimicked how computer scientists work, “The Make-a-thon project showcase for each strand propelled the girls into what real computer scientists/engineers do all the time and how they work hand in hand to see each project through to completion in time and to the best of their abilities. The projects really stretched their thinking and their beliefs in what they were capable of achieving.”

✓ Relationship building was mentioned by five educators in the reflection survey as important to the program’s success. Girls were given the chance to bond over the length of the program and become a strong unit, “We included a lot of intentional team building into the program. The girls bonded well together very quickly and we had few issues with "clicks" or negative attitudes. Building that sense of team created an environment where girls who were more advanced could help others without it being seen as bragging or bad in some way to receive that help. They became a group of friends who were sad to finish the program.”

✓ Exposure or access to resources for educators and girls was also very important: “The supplies were crucial. It was so awesome that we had everything that we needed for the program. The girls were so excited to get their hands on the tech and felt so special.”

✓ Other factors identified by educators included: Good educators (with CS and youth engagement skills) and an organized project website.

✓ Offering webinars a few months in advance of the in-person training so that educators an opportunity to become familiar with the project team and other partner sites, the overall goals of the project, and some more logistical and background information. This saved the in-person time for educators to do more hands-on activities that was so important for learning and becoming comfortable with new technology.

✓ Connecting the educators to each other (through ongoing webinars, at the in-person training, and through Google Groups, LRNG and Flipgrid) so that they could learn from one another rather than having them reliant only on the SciGirls Code project team for support.

✓ The intensively hands-on experience of the in-person training in giving the educators a sense for what their participants would be doing during the program.

✓ SciGirls Code had more staff assigned to this project compared to other TPT projects (each working a smaller percentage of time), which has been a success in terms of dividing the workload, sharing duties at the training and in offering ongoing support, and will be useful as the project looks to scale-up.
The **Connected Learning** aspect for girls, which was using Flipgrid to share their work, see others’ work, and exchange comments, worked well. According to many, girls really enjoyed when somebody else posted on their project.

**SCALE-UP**

22. **To what degree did local adaptations at partner sites affect the success of the project?**

**Key Findings**

- Role model visits were not as widespread as they could have been, meaning that girls were not as exposed to the role models and their impact.
- Many sites shortened or cut activities in the curriculum and the program felt rushed to complete all of the curriculum and other components. However, differences in learning and other impacts are not noted.
- Some adaptations were educators being responsive to the interests of the girls, perhaps increasing their satisfaction with the program.

*The SciGirls* Code leadership team expected that sites would make adaptations in their implementation and they sought information on those experiences to help them learn what worked well and what was not as effective.

**Role models and Career Exposure**

Due to most sites describing that they were short on time to implement the program, girls did not interact with role models and girls from other sites at the same frequency the project team initially intended. While low exposure to role models either via Flipgrid or in-person, likely did not have a negative effect on girls, some girls did miss the opportunity to have the positive interactions others had. As referenced earlier in the report, role models had a positive influence on girls. By exposing more girls to role models more regularly, the positive effects of role models could be more widespread. Likewise, as documented earlier in the report, some girls enjoyed seeing other girls’ work through Flipgrid. With a reduction in Flipgrid use due to time constraints among others challenges, this positive influence may not have been as widespread as it could have been.

**Curricular adaptations**

Also as a result of time, several educators, as documented earlier in the report, shortened the E-textiles strand and often skipped makeathons or combined makeathons with other activities. While these adaptations may have brought stress and concern to educators, it also encouraged them to align the programming with the interests of the girls. Educators indicated skipping or changing the timing of
certain activities to better align with the interests of the girls. The need to shorten and skip activities encouraged the educators to remain flexible and responsive to the girls in order to provide them with a positive computer science experience.
Areas of Consideration

The following recommendations emerged from the data, directly from respondents, and from analysis by the evaluation team.

- **Add an online “help center” for educators and/or participants** to access with more detailed instructions, trouble-shooting tips, facilitation tips, and technology support.
  - “Biggest thing is having more accessible How-tos for the actual coding lessons/activities. [My co-educator] and I found ourselves having to regurgitate to simplify the coding activities for AppInventor, ArduBlock and especially Arduino (which is hard for adults who are not in the CS career field). Maybe embed some more How-to videos and visuals for girls and teachers. Maybe cut down on some of the easier activities so to have enough or more time for the actually coding since that was always the hardest for the girls.” (Educator, Reflection Survey)
  - Any training videos for the more difficult parts of the curriculum would be helpful. (Educator, Reflection Survey)
  - “More detailed instructions, and a help center.” (Participant, Post-Survey response)

- **Allow more time for activities** within each strand. Educators struggled to find the time to complete the activities of the strands and the most common adaptation was to skip, shorten, or combine activities or the makeathon. Even the girls felt time pressure to complete activities.
  - “We didn’t always finish projects on time so we would feel stressed on falling behind on projects.” (Participant, Post-Survey response)

- **Integrate Flipgrid** for participants (Connected Learning) into the curriculum so it is not an ‘extra’ component which may be skipped.
  - “They love Flipgrid and I think being able to see what other girls are doing in other areas of the country is a huge benefit, but that wasn’t added into the time for the curriculum.” (Educator, Reflection Survey)

- **Engage more role models in the training and/or revise the training format to be more convenient.** According to the data available, SciGirls Code role models were not very likely to have participated in the online training sessions, which were two one-hour long webinars. A different format to deliver the content in the training could have reached more role models. In addition, more training on serving as a role model online (via Flipgrid or via web video) was requested.
• **Embed role model visits into the curriculum.** The flexibility of the role model component, to allow sites to communicate and book different types of role model visits, meant that it required decision-making and the time and effort of educators and, therefore, was at-risk to be skipped (especially when educators felt short on time). The curriculum could suggest ways for a role model to assist during an activity for in-person or virtual visits, or part of a curriculum activity could involve watching a Flipgrid role model video.

• **Designate a role for role models** to take during their visit, if needed. Role models without much experience or who did not have a lot of time to prepare to guide an activity would have appreciated detailed guidance on how to meet girls and assist with an activity.
  
  o **“My advice is to be more specific on my role. I want to be useful, not just sit here for two hours.”**

• **Factor in more prep time for educators** to learn the activities, technology and learning goals and how to facilitate girls’ learning.
  
  o **“It needs to be someone’s full-time job, if you want to meet all those goals, you need someone who’s able to commit 20/30 hours a week to this program. If you want to hit all of those points, you need to hire someone who has lots of time to sit and troubleshoot; it needs to be a teacher.”**

• **Consider changes in the technology software or hardware** used for different strands, especially a replacement for Hummingbird and Arduino, which many educators struggled with. The consumable materials in the E-textiles strand would be costly for sites to continue to purchase on their own in order to continue the program.

• **Add a “middle” layer of support** for educators. When educators wanted to lean on each other for support and a sharing of ideas, they were not sure if other educators would be able to answer their questions.
  
  o **“If there was a site with a part-time staff member...like a middle-man hub coordinating, it might have helped with the questions going to SciGirls. Maybe they directed us to Hummingbird because they are also answering a million other questions. A middle layer might help them.”**

• **Provide another time or way for educators to re-connect and get more training.** The in-person training was very popular and effective, but it was held about five months in advance of the program being implemented at sites. Another opportunity for educators to receive more training, aside from the monthly webinars, would be valuable, both as a means to re-energize
the community of educators and to provide more timely training on the later strands (E-textiles). For example, a local training for smaller groups of educators with content specialists skyping in or attending the training in-person.

- **Have girls create a digital portfolio** of what they learned for each activity or strand.
  
  - “A digital portfolio would be a good way to have the girls reflect on the activity and relate that back to real world applications and it would be easy to share with parents.”

- **Consider shorter-term programs.** Modifying the format where it’s not a full-year commitment would make it more accessible to girls and possibly to more educators to integrate a curriculum strand into an existing program.
  
  - “The year-long program was challenging in many ways: I think we would have expanded participation and impacted more girls if we had offered the program in a more flexible, modular format.”

**Summary**

SciGirls Code was a successful pilot project on many levels. Partner organizations and educators were engaged and largely very satisfied with the support offered by SciGirls Code to implement nine-months of programming with girls in their site. Every site completed the program, though not without challenges. The in-person training was especially lauded by both the project team and the educators, especially for establishing community among educators in a short period of time. Finally, the SciGirls Team is excited to put their knowledge in use; making changes in the program structure and building upon what worked well to offer another iteration of SciGirls Code. All partner sites were planning to continue with all or parts of the SciGirls Code curriculum, activities or other components, and seeking to engage more girls in computer science learning.