

**Designing Our World
Grant Year 3 Phase I
Summative
Evaluation Report**

Prepared for
**Oregon Museum of
Science and Industry**
Fall 2016



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Overview



Overview

Designing Our World (DOW) is a 4-year National Science Foundation (NSF)-funded initiative in which the Oregon Museum of Science and Industry (OMSI) seeks to promote girls' pursuit of engineering careers through community-based programming, exhibition development, and identity research. The overarching aim of DOW is to engage girls ages 9–14 with experiences that illuminate the social, personally relevant, and altruistic nature of engineering. Target audiences for the project include girls who participate in programming, professional audiences, caregivers, and members of the public who visit OMSI.

This report presents findings from Year 3 of the initiative and corresponds to Phase 1 of the summative evaluation. Year 3 programming was delivered in partnership with two community-based organizations (CBOs): Adelante Mujeres and Girls, Inc. Adelante Mujeres serves low-income Latinas and their families in western Washington County, Oregon. DOW was implemented as part of its Chicas Youth Development after school program at Echo Shaw Elementary School in Forest Grove, Oregon. Girls, Inc. serves girls throughout the U.S. and Canada. DOW was implemented as part of its Girl Group that meets at Woodmere Elementary School on the southern edge of Portland, Oregon near the border with Clackamas County. (In the previous year, the project also included Boys and Girls Club as a third partner, but they were not included in Year 3.)

OMSI staff and CBO staff partnered to engage girls in engineering activities that highlighted real engineering careers and showcased the altruistic nature of engineering through challenges such as designing a wheelchair-accessible ramp and engineering surgical tools for specialized tasks. Programming also included discussions and reflective activities focused on gender equity, stereotypes in STEM, the nature of engineering practices, the nature of engineering careers, and personal experiences. Female engineers took part in the activities, serving as role models and providing girls with in-person examples of engineering careers. At Adelante Mujeres, the seven DOW lessons were implemented in English and Spanish over seventeen weeks; thirty girls participated. At Girls, Inc. the seven lessons were implemented in English over six weeks; fourteen girls participated. (See Appendix A for lesson plans.)

OMSI staff also conducted workshops for caregivers at both CBO sites during Year 3. The Adelante Mujeres workshop was held March 9, 2016, and the Girls, Inc. workshop on April 19,

2016. In addition, OMSI staff conducted professional development (PD) workshops with CBO staff. At both sites, OMSI staff held a half-day orientation meeting, professional development sessions that lasted two hours each (three sessions at Adelante Mujeres and two at Girls, Inc.), and a full-day workshop. OMSI staff also led reflective discussions with CBO staff. Attendance numbers were not recorded at the caregiver or staff sessions.

Evaluation Questions

The key questions for the Phase 1 summative evaluation for the DOW program are:

Girls Participating in DOW Program

- Are participants engaged in the program? Do they enjoy their experience in DOW?
- Do participants gain an understanding of what engineering is? Do they develop an understanding that engineering is an approach to solving everyday problems that is collaborative, altruistic, and personally relevant?
- Do participants develop a sense of self-efficacy/confidence in using engineering processes and skills?
- Do participants develop an awareness of engineering careers?
- Do they develop a positive view of engineering careers?

Caregivers Participating in DOW Program

- Do caregivers engage in the workshop and engineering-related DOW activities and enjoy their experience?
- Do caregivers develop awareness of gender inequity in engineering and that engineering can be an accessible career option for girls?
- Do caregivers learn strategies to support girls in their lives as they engage in engineering activities in both school and home?
- Do caregivers feel comfortable in their ability to support girls in pursuing engineering activities?

CBO and DOW staff involved in the program

- Does CBO staff develop awareness of gender inequity in engineering and that engineering can be an accessible career option for girls?
- Do CBO and OMSI staff participating in DOW learn about ways to make engineering relevant to girls (e.g., altruistic, relevant, social)?
- Do CBO and OMSI staff participants learn strategies of ways they can support girls in their lives to engage in engineering activities and do they feel confident in their ability to apply these strategies?

DOW Educational Model

- Overall, how does the DOW program model play out in the different two communities/contexts in which the program is implemented? What are some of the factors that seem to influence program implementation across two settings and what are some resulting insights that can inform future programming within community settings?

Methods

This study was grounded in culturally responsive approaches to evaluation, in which the evaluator considers the culture and context of participants and of the program as critical aspects through which to examine the project's goals and its impact (Frierson, Hood, and Hughes, 2010). In spring 2016, a diverse team of bilingual/bicultural researchers collected data from participants in English and Spanish, as appropriate, based on participants' preferences. All data collection instruments were developed by Garibay Group simultaneously in English and Spanish to ensure construct equivalence.

The study employed a mixed-methods design (Greene & Caracelli, 2003) that combined quantitative and qualitative data. Specific methods used in this study included the following:

Girls

- *Girls' pre-program and post-program surveys:* Girls completed surveys during the first and last program sessions. Surveys focused on girls' understanding of engineering, attitudes about engineering, and enjoyment of the program.
- *Girls' pre-program and post-program assessment:* Girls completed a pre-program and post-program assessment of engineering understanding during the first and last program

sessions. The assessment was drawn from an activity developed by Dr. Heidi Carlone that explores students' understanding of engineering competence (Carlone, 2016). Girls were presented with an outline of a person and two options for filling in each color-coded body segment to construct a "good" engineer. Students could choose one option and place it in its corresponding color-coded location on the figure. For example, girls were able to select either "creative" or "smart" to fill in the head of their figure.

- *Girls' session debriefs:* OMSI staff participated in a structured debrief session following each DOW session to capture information about the session, including girls' engagement and evidence of their collaboration as well as what worked well and what might be improved. Staff recorded their reflections using a debrief form and evaluators then analyzed the information. A total of 14 debriefs were completed (7 per site).
- *Girls' focus groups:* In order to gain a deeper understanding of girls' experiences, evaluators conducted two focus groups with girls at the Adelante Mujeres site. The focus groups took place two weeks following completion of the DOW program and included all girls who were present at the selected dates and times. Evaluators used interactive activities and techniques tailored to participants' age range. Participants declined to be audio-recorded during the focus group, so evaluators took notes during the session and audio-recorded a detailed debriefing conversation immediately after. Each girl received a \$10 gift card honorarium for her participation. Focus groups were not conducted at Girls, Inc. because evaluators did not have access to DOW participants once the program had ended.

Caregivers

- *Caregiver workshop survey:* Caregivers completed a survey at the end of a workshop. The survey focused on caregivers' enjoyment of the workshop along with their perceptions of its utility. The survey also asked caregivers about the effect that the workshop had on their awareness of engineering, the value they placed on engineering, their confidence supporting their daughters in engineering, and strategies to support girls.
- *Caregiver focus group:* Evaluators conducted two focus groups with caregivers at the Adelante Mujeres site. Conversations focused on a range of issues including learning about parents' priorities and values regarding their daughters, motivations for enrolling their girls in Adelante Chicas, and their perspectives on the DOW program and OMSI. The focus groups

took place two weeks following completion of the DOW program. CBO staff invited all parents of DOW girls to participate. Participants received a \$25 honorarium for their participation. One focus group was audio-recorded. Participants in the other group declined to be audio-recorded during the focus group, so evaluators took notes during the session and audio-recorded a detailed debriefing conversation immediately after.

Staff

- *CBO staff workshop survey:* Staff from Girls, Inc. and Adelante Mujeres completed a paper survey immediately following the workshop. The survey focused on satisfaction and usefulness of the workshop. The survey also asked participating staff about the effect on the workshop on their awareness of engineering careers, inequity in engineering, the value they placed on engineering, and their learning on how to make engineering relevant to girls. (
- *CBO staff interviews:* Interviews provided an opportunity to reflect with key staff at each community partner site on the DOW program, including on its perceived value and the impact of the program on staff and their organization. Conversation also provided an opportunity to reflect on the collaboration between OMSI and their organization. Two group phone interviews were conducted (one with each partner site). Interviews were audio-recorded and transcribed for analysis.
- *Reflective discussions:* OMSI staff led group discussions with CBO staff at each community partner site to reflect on girls' interactions and experiences in the DOW program. Discussion provided attendees opportunities to learn what the OMSI research team (which is investigating girls' engineering identity as part of the DOW program) was learning and to share their own perspectives about girls' interactions. These discussions were intended to serve as a kind of professional development. The conversations were fairly unstructured, with just a few key areas identified ahead of time for exploration. Three discussions were held and recorded at Adelante with three or four CBO staff participating in each session. Two discussions were held at Girls, Inc. with three CBO staff participating in each session.
- *OMSI staff interviews:* Evaluators conducted a group phone interview with OMSI staff members to reflect on their experiences with DOW and the influence of the program on their own learning. We also explored areas of DOW that felt especially successful as well as its challenges. The interview was recorded and transcribed for analysis.

Sampling Frame

Surveys were collected from everyone present at a session. For focus group data, we used a convenience sample. Although all caregivers were invited by Adelante staff, parents self-selected for participation. For staff interviews, we used purposive sampling and invited staff who had been directly involved with the program. As participation was voluntary, staff also ultimately self-selected to participate.

Data Analysis

Quantitative data were analyzed using basic descriptive statistics and summarized in bar charts and tables. Surveys and assessments were matched to obtain individual baseline and post-program response comparisons and statistical testing was conducted to identify significant differences between pre-program and post-program data. We present survey and assessment responses in percentages (some percentages do not add to 100% due to rounding). Where appropriate, the actual number of responses (*n*) is provided.

Qualitative data from focus group interviews, open-ended survey items, and staff interviews were recorded in the original language (English or Spanish) in which data were collected, allowing evaluators to capture nuances not always directly translatable from one language to another. Data were then analyzed using inductive coding (Strauss and Corbin, 1990; Patton, 1990), which allowed researchers to identify emergent patterns and themes in the data without the limitations imposed by predetermined categories. As patterns and themes were identified, researchers teased out the strength of these patterns and themes (Miles and Huberman, 1994).

Limitations

As in any study, this evaluation had certain limitations. Surveys and assessments were administered to all girls present during the appropriate session. Although the aim was 100% participation, we were not able to obtain data from all girls in the program due to normal attendance fluctuations (e.g., girls absent on days data were collected, drop-out rate). In addition, the number of girls participating in DOW was small. Therefore, the sample size should be considered when interpreting results. Another limitation relates to the nonparametric statistical tests used to analyze the pre-program and post-program data in this study. One assumption of these tests is that the majority of respondents will change their responses

between pre- and post- data collection. We encountered a violation of this assumption, however, because few respondents demonstrated change.

Caregiver focus groups were only conducted at the Adelante Mujeres program sites. Although all caregivers with girls participating in DOW were invited, respondents for focus groups were ultimately self-selected.

Finally, not all staff who participated in DOW at the community partner sites, or who delivered programming for OMSI at these sites, participated in interviews.

Respondents

Girls

Data were collected from 40 girls, a total representing 91% of the population that participated in DOW. The number of respondents for individual instruments and items ranged from 17 to 40. The majority of respondents were 10 years old (58%) and in fourth grade (55%) (See Figures 1 and 2).

Figure 1. Age of Respondents

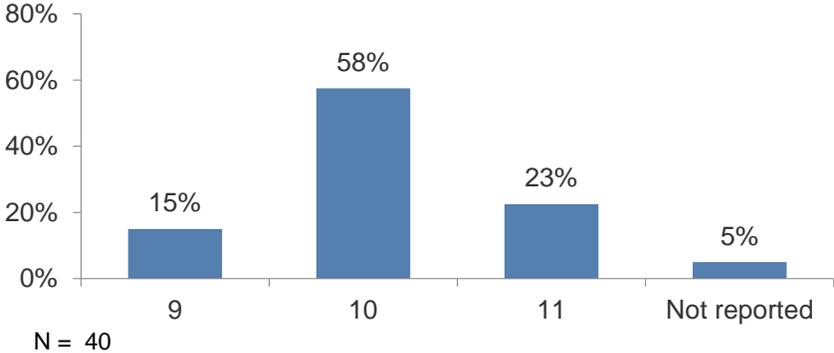
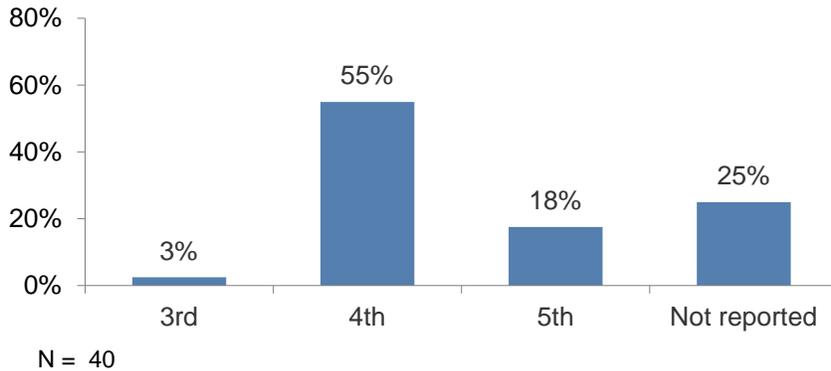
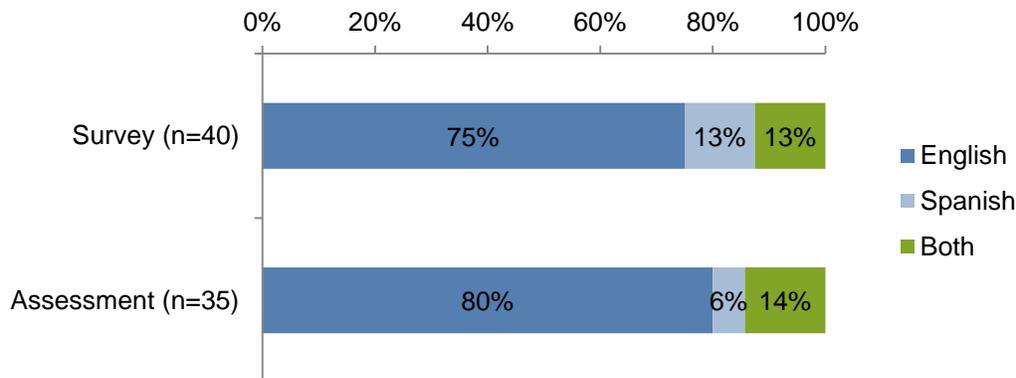


Figure 2. Grade of Respondents



Approximately three-fourths of respondents chose to provide data in English (75% for survey, 80% for assessment) (See Figure 3). A total of 15 girls participated in focus groups. The focus groups were conducted in a blend of English and Spanish, with the majority of the conversation taking place in English.

Figure 3. Language Used by Respondents



Caregivers

Twenty-four caregivers completed post-workshop surveys. The majority of workshop participants did not have girls participating in the DOW program. OMSI staff reported that this was because Adelante Mujeres invited all of their program participants to the workshop rather than limiting attendance to caregivers of girls in DOW. Of respondents, 63% (n=16) were from the Adelante Mujeres workshop. All respondents from Adelante Mujeres completed the survey

in Spanish, while all Girls Inc. respondents completed the survey in English. Six adults participated in the caregiver focus groups, which were conducted entirely in Spanish. No other data were available about workshop participants. Each focus group participant had a daughter who had participated in DOW at the Adelante site. All focus group respondents were immigrants from Latin America, the majority coming from Mexico. All were native Spanish speakers.

Staff

Ten workshop participants completed surveys (7 respondents worked at Girls, Inc. and 3 at Adelante Mujeres). Three staff members from Adelante participated in a group interview. At Girls, Inc., two staff members participated in a group interview. No participation logs were kept, so no additional information is available about the respondents.

Seven CBO staff participated in reflective discussions (3-4 at Adelante and 3 at Girls, Inc.). At Girls, Inc., participating staff included the Program Coordinator, the Community Engagement Manager, and an individual responsible for directly conducting program sessions with girls. At Adelante, participating staff included the Youth Development Program Manager, two site facilitators, and a parent coordinator.

For CBO staff interviews, three individuals participated from Adelante, which included the Youth Development Program Manager, a site facilitator, and a parent coordinator. At Girls, Inc. the Program Coordinator and the Community Engagement Manager participated in the interview.

Two OMSI staff members—the Senior Learning and Community Engagement Specialist and the Curriculum Developer—participated in a group interview. Both participants were part of the team that developed the DOW curriculum and conducted sessions with girls, caregivers, and CBO staff.

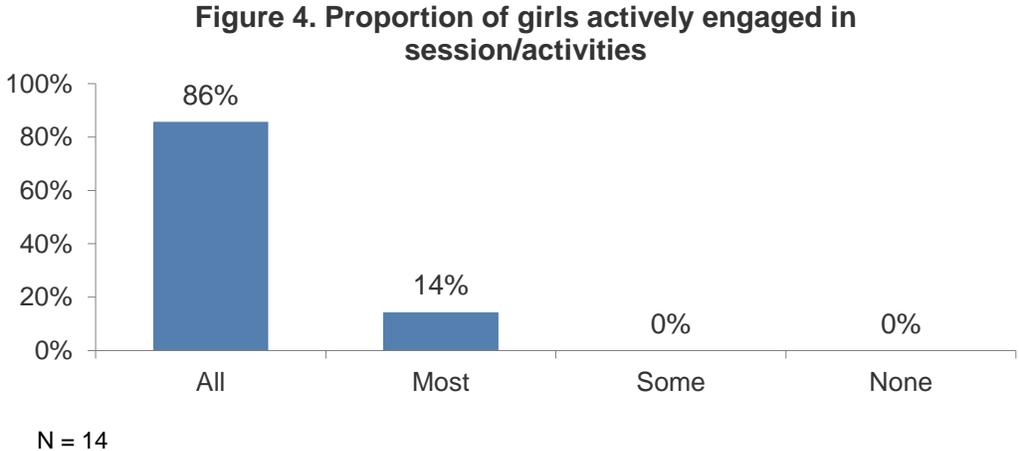
Results: Girls



Results: Girls

Engagement

The evaluation sought to determine whether girls were engaged in and enjoyed their experience with DOW. Following each session, staff members reflected on the proportion of girls that they had observed who were actively involved in the activities and recorded it on debrief forms. For the vast majority of sessions ¹(86%), staff reported that all of the girls were actively engaged (See Figure 4).

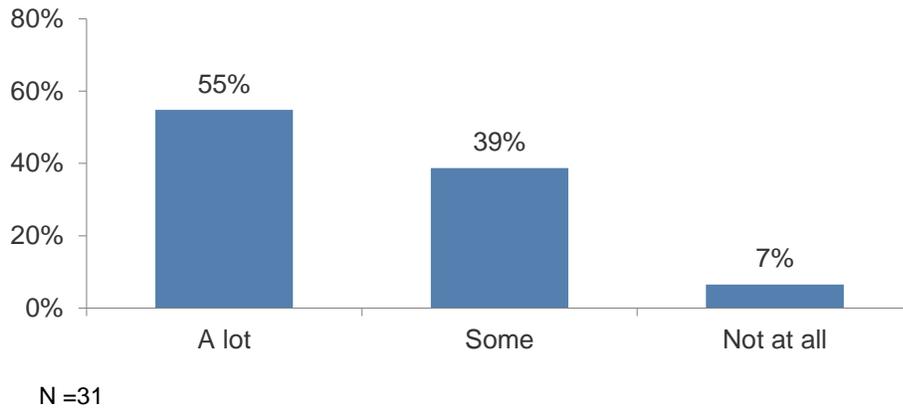


Staff noted that the girls demonstrated excitement for the program and the activities. For example, staff wrote that girls were proud to show off their designs during the *Slow-it-Down* activity in Session 4 at Girls, Inc. (as noted on p.3, lesson plans are included in Appendix A). The only explicit mention of disengagement came in Session 7 at Adelante Mujeres, when staff noted that the girls at one site were not interested in the assembly line activity.

In the post-program survey, nearly all the responding girls (93%) reported enjoying the DOW program (See Figure 5).

¹ Staff delivering program sessions did not consistently track number of total number girls and number activities on data debrief sheets.

Figure 5. Responses to: "How much did you enjoy the Designing Our World Program?"



To help us understand which components of the program were most engaging, girls were asked about the program’s most enjoyable components. In the pre-program survey, respondents were asked what they *anticipated* would be the most fun aspect of the program. Then, in the post-program survey, respondents were asked which aspect actually *was* the most fun. Responses are summarized in Table 1.

In both surveys, the most frequent category of response was being part of the group of girls (47% of responses pre, 38% post). This indicates that, for many girls, being part of the group was both anticipated to be fun and actually was fun. The relative frequencies of the other response categories changed from the pre-program survey to the post-program survey. Although field trips were anticipated to be fun (ranking second among the response categories), this category dropped to the lowest-ranked category in the post-program survey. This seems to indicate that field trips were either less fun than anticipated or that other components of the program turned out to be more enjoyable than anticipated. In contrast, the activities category rose from the third-ranked category in the pre-program survey to the second category in the post-program survey. This seems to indicate that the activities were more fun than respondents anticipated.

Table 1. Most fun part of the program

Response Category	Responses to: "What do you think will be the most fun part of this program?"	Responses to: "What was the most fun part of this program?"
	% of Responses (N=17)	% of Responses (N=21)
Group	47%	38%
Field trips	24%	10%
Activities	18%	33%
Learning	12%	19%

During the focus groups, participants listed and described many DOW activities without prompting and also noted that they wanted more activities. The “poonami”, zip line, and surgery activities were all mentioned immediately during the ice breaker activity and again throughout the discussion. Evaluators asked girls to name their favorite part of DOW. Several girls mentioned specific activities that they enjoyed:

“When we had to do the build this zipline for the people who got hurt.”

“My favorite part was when we had to solve the puzzles, making the tools to solve the puzzles.”

“The sponge one and the poonami and the zipline.”

The girls were also asked to explain what made the activities fun.

“Because it makes you think.”

“Me inspire (“I was inspired”).”

“You had to be kind of smart and you had to let other people take turns giving their ideas.”

Several participants also mentioned the visits from female engineers as a positive part of DOW. They described the content of those visits as well as the names of the engineers. When asked to say a word that came to mind when they thought of the DOW program, one of the girls said the name of the plant engineer who helped with the “poonami.” Participants said they would recommend more visits from female engineers when DOW was implemented in the future. Participants also mentioned the use of inspirational quotes and the food as positive parts of DOW.

One program challenge that was identified during the focus group related to timing. Some participants said that they wished that there had been more time to do the activities and that they felt like they had not been able to complete the activities as fully as that they wanted due to time constraints. In contrast, many fifth grade participants said that they finished activities quickly because they were too easy. Some girls (specifically, the fifth graders) reported that some activities were boring.

“Some of [the activities] were fun and some of them were boring: the poonami was boring and the plant one.”

“It was boring and it made me sleepy.”

“We didn’t get to play around too much.”

“The one where we had to build tools was boring.”

Nearly all of the participants said that the research-related video and audio recording that took place during DOW negatively impacted their enjoyment of the program. For example, one girl reported that she felt pressure and was distracted because researchers might see girls “do it wrong or steal our idea if we do it right.” Several participants commented that they weren’t allowed to choose who they wanted to partner with or sit near because some girls were part of the research study and others weren’t. A couple of participants described OMSI staff as “bossy and too serious.”

Understanding of engineering

DOW sought to convey a conceptualization of engineering as a collaborative, altruistic, and personally relevant approach to solving everyday problems. To assess girls’ understanding, the post-program survey asked respondents to describe the positive parts of being an engineer in their own words. Nearly half of the responses (44%) related to altruism or collaboration (See Table 2).

Table 2. Responses to: "If you wanted to tell someone about the positive parts of becoming an engineer, what would you say?"

Response Category	% of Responses (N=37)
Helping others/environment	22%
Working with others	22%
Being creative/having ideas	16%
It's fun/cool	16%
Trying/working hard	16%
Being smart	5%
Learning	3%

Responses included:

"I would say that you get to work with others, you get to do something kinda like trial and error and you get to create cool stuff!"

"An engineer is a person who is really important to the environment and our community wouldn't be the same without them!"

"Ayuda a la gente." ("[It] Helps people")

"They get to help people with things and turn learn stuff with other people. They always try their best."

"Smart, creative, helpful, make ideas, don't be scared to try new thing."

"Echarle muchas [ganas] al trabajo para tener éxito en la vida." ("Give [your all to] work to have success in life.")

"I would say, 'It's positive because you get to help people and solve problems for people.'

During the focus groups, evaluators asked participants to explain what engineering is and what engineers do. Participants demonstrated a basic understanding, explaining that an engineer is someone who designs things and makes things to help people, someone who helps do "cool" things, or someone who researches things. The concept of engineering as altruistic was strongly present in the focus groups.

"Do something to build something to help the environment or people."

“Una persona que hace cosas para ayudar al planeta. O [hace] robots que nos ayudan en la casa.” (“Someone how does things to help the planet or makes robots to help us at home.”)

“It makes stuff that could help people like making school safer if there was a hurricane.”

“It’s fun porque ayudas a la gente...tienen que trabajar juntos para hacerlo.” (“It’s fun because you help people...they have to work together to do it.”)

“Can be something where you design or make or research things. Like Elizabeth studied sounds from whales and dolphins, you can create stuff.”

Other responses reflected additional characteristics of an engineer that DOW sought to convey.

“Imagination and be cooperative.”

“When you build something and you keep on trying even though you’ve failed because you never give up.”

“Always use your imagination, use your creativity.”

“Hardworking, problem-solving.”

“Being nice, helping people.”

“It takes tech skills, cooperation, and being creative.”

A few responses, however, seemed to demonstrate misunderstandings about engineering:

“Engineering is when you build something.”

“You don’t have to do math.”

“You have to be smart.”

Some girls in the second focus group articulated the difference between types of engineers by using the example of a female engineer who visited during one of the program sessions. They asserted that she didn’t make things, but instead listened to sounds. Overall, many participants were able to articulate the most basic concepts and several participants demonstrated an understanding of more nuanced aspects of engineers and engineering.

As the program unfolded, OMSI staff members used the debrief forms (described on page 5) to describe the extent to which they felt the girls were understanding the nature of engineering. One area on which they frequently reflected was collaboration. On some debrief forms staff members described examples of strong collaboration among the girls (for example, Sessions 2 and 3 at Adelante Mujeres; Session 4-7 at Girls Inc.). For example, staff recorded one example in which girls in one group delegated tasks to other girls and that all of the tasks collectively contributed towards the final product (Session 7 at Adelante Mujeres). Also, during the “poonami” activity, staff noted that in one group a single girl drew while the other girls contributed ideas (Session 4 at Adelante Mujeres). Other debrief forms included descriptions of a moderate level of collaboration. For example, staff described a group in which two girls made designs by themselves and then tested to see which was better (Session 6 at Adelante Mujeres). Some forms noted a lack of collaboration among the girls. For example, staff recorded that girls worked separately within their groups during many sessions (for example, Session 5 at Adelante Mujeres). On some forms, staff recorded examples of girls resisting collaboration (for example, Session 4 at Adelante Mujeres).

Staff recorded mixed reflections on the extent to which girls learned about the altruistic nature of engineering. Staff noted that some girls seemed to relate session activities to altruistic goals. For example, staff members noted that some girls had considered the end-users’ comfort and safety during the zipline and wheelchair activities (Sessions 4 and 5 at Girls Inc.). On other forms, however, staff wrote that they felt a need to improve the presentation of the activities in order to make their altruistic goals clear to the girls. On another debrief form, staff members reported that when a visiting female engineer spoke about altruism, the team did not see evidence that the girls understood or “picked up on it” (Session 3 at Girls Inc.)

Debrief forms also indicated that staff felt that only a few of the activities and sessions elicited strong feelings of personal relevance for the girls. One example was a session in which girls came up with the idea of engineering technology as a tool to communicate with relatives who live in other countries. In another session, a biomedical engineering activity was framed as altruistic by talking about creating tools to help a surgeon perform surgery on a dog or a person. Staff members noted that girls at one site demonstrated excitement about surgery and empathy toward the dog (Session 5 at Adelante Mujeres). At the other site, however, staff noted that some girls “had little to no concern about the animal” (Session 7 at Girls Inc.) Staff also wrote about ineffective attempts to make the activities relevant to girls’ lives. For example, in the

biomedical engineering activity, staff said that they used the word “veterinarian” to help the girls relate to the task, but that this was not successful (Session 7 at Girls Inc.) In another session, they noted that a visiting female engineer drew connections between engineering and a local river, but only a few of the girls were familiar with the river (Session 4 at Adelante Mujeres). Nonetheless, staff noted that during the final session wrap-up discussion, many girls were able to provide engineering-related responses to the prompt, “If you could solve any problem in the world...” They wrote that the girls talked about problems ranging from transportation and shelters for weather emergencies to recycling, eyeglasses, and robots.

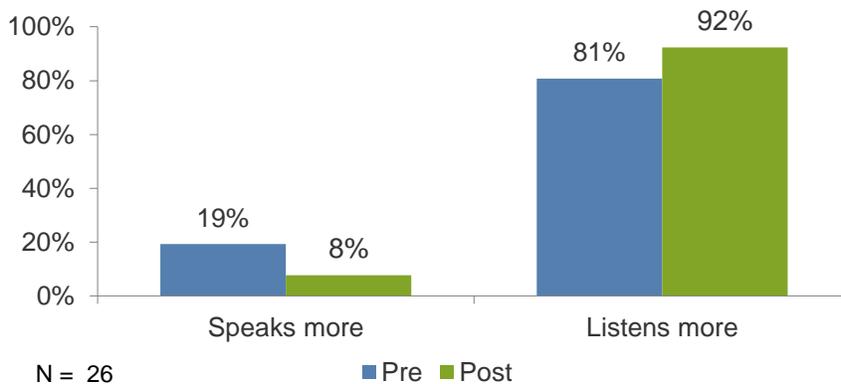
The pre-program and post-program assessments sought to capture changes in the girls’ understanding of engineering competence, specifically the eight pairs of misconceptions and attributes listed in Table 3. Respondents were asked to select the word or phrase from each pair that they felt best characterized a “good” engineer. No significant differences were observed between the matched pre-program and post-program assessments.

Table 3. Engineering competence

Misconceptions about engineers	Attributes of engineers
Smart	Creative
Talks more	Listens more
Successful on first try	Never gives up
Knows a lot	Good problem-solver
Likes to compete	Likes to cooperate
Happy with one idea	Thinks of many ideas
Keeps ideas to self	Shares ideas with others
Does not have to try very hard to do well	Works hard to do well

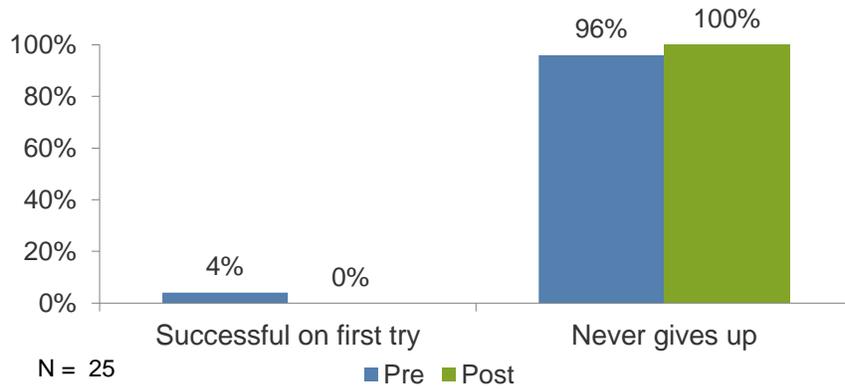
For six of the eight pairs of characteristics, the vast majority of respondents (greater than 80%) selected the desired responses in the pre-assessment (See Figures 6–11). For example, 96% of respondents in the pre-assessment said that an engineer never gives up and 84% said that an engineer is a good problem-solver. This bunching of responses at the upper (or high-achievement) end of an instrument’s response range is called a ceiling effect, and it results in an inability to detect differences when gathering repeat measurements. The ceiling effect in this case may have been due to the small sample size and/or the dichotomous nature of the instrument that—by nature—results in less variability among responses than does an instrument offering more choices. This effect could also have arisen had respondents possessed prior exposure to the conceptualization of engineering competence or were able to deduce the desired responses.

Figure 6. Responses for "Blue Arm"



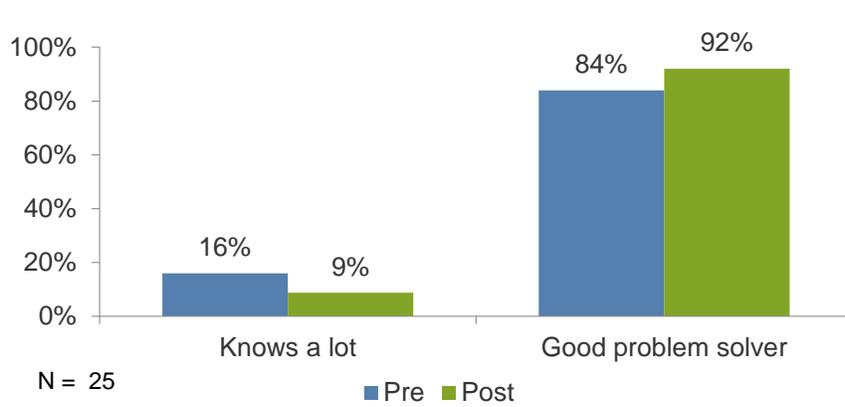
McNemar Test, N=26, p=.453
 Statistically significant when p<.05

Figure 7. Responses for "Purple Arm"



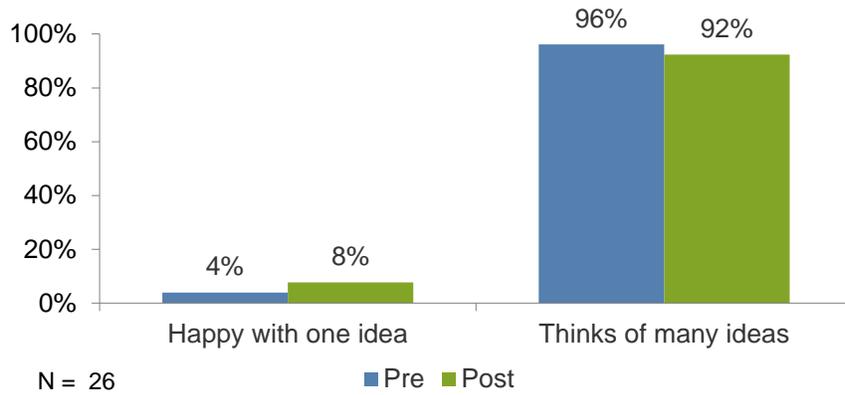
McNemar Test, N=25, p=1.00
 Statistically significant when p<.05

Figure 8. Responses for "Red Chest"



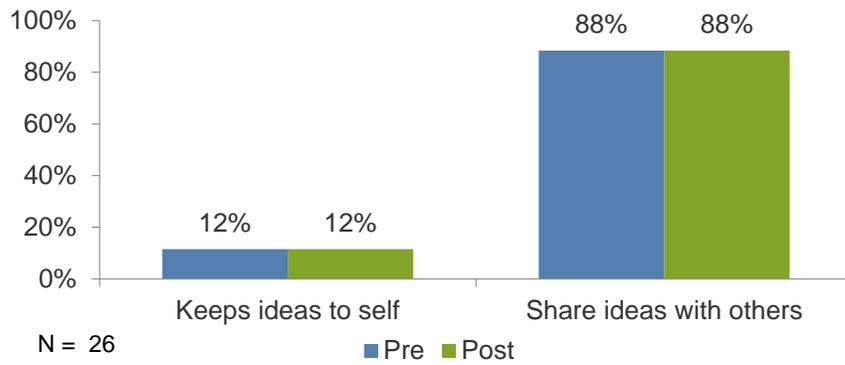
McNemar Test, N=25, p=.625
 Statistically significant when p<.05

Figure 9. Responses for "Yellow Shorts"



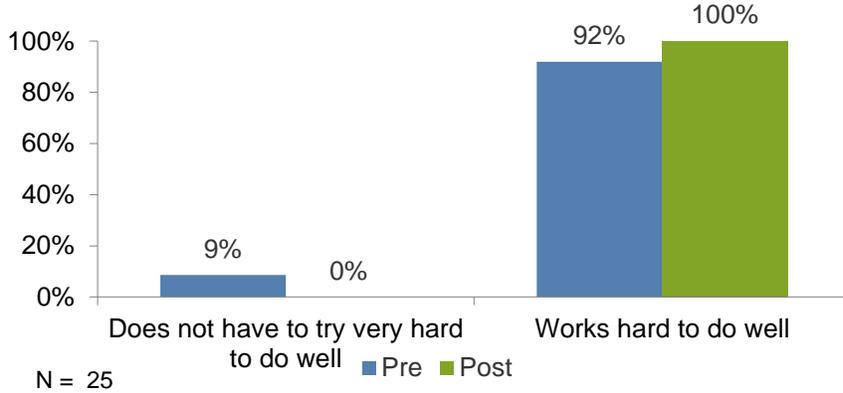
McNemar Test, N=26, p=1.00
 Statistically significant when p<.05

Figure 10. Responses for "Orange Leg"



McNemar Test, N=26, p=1.00
 Statistically significant when p<.05

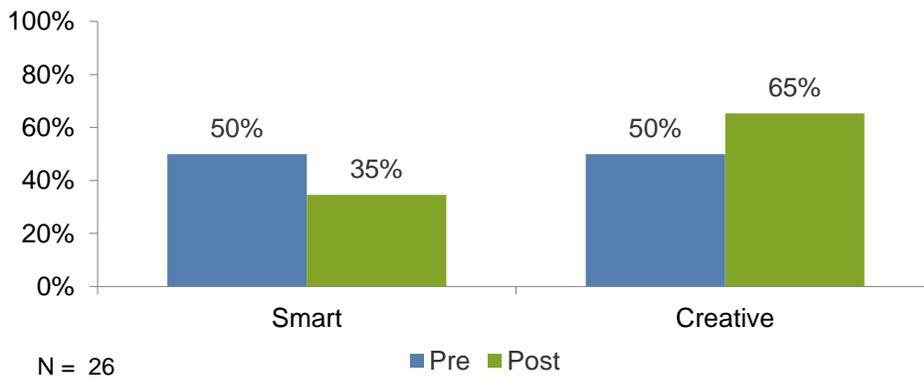
Figure 11. Responses for "Green Leg"



McNemar Test, N=25, p=0.500
 Statistically significant when p<.05

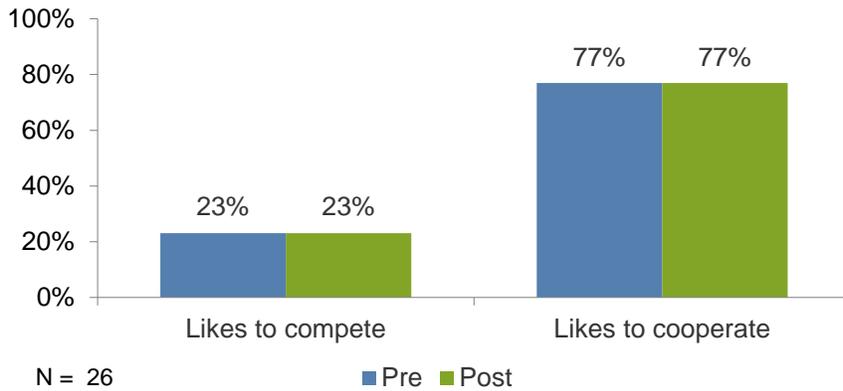
For two of the eight pairs of characteristics, no ceiling effect was observed (See Figures 12 and 13). For both of these assessment items, individual respondents were observed to remain unchanged and to move in both “directions” from the pre-program assessment to the post-program assessment. That is, some individuals selected a misconception in the pre-program assessment and an attribute in the post-program assessment while others did the opposite.

Figure 12. Responses for "Green Head"



McNemar Test, N=26, p=.388
 Statistically significant when p<.05

Figure 13. Responses for "Blue Chest"



McNemar Test, N=26, p=1.00
 Statistically significant when p<.05

The participant survey included two additional items that explored respondents' understanding of engineering. As depicted in Figure 14, nearly three-quarters of those responding (71%) in the pre-program survey agreed that engineering is about solving problems to help people. No significant differences were observed between the pre-program and the post-program survey (See Figure 15).

Figure 14. Pre-Survey Responses to: "Engineering is about solving problems to help people"

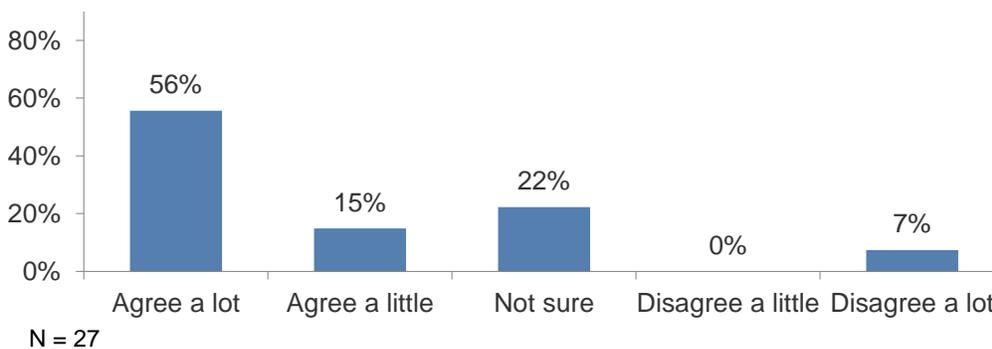
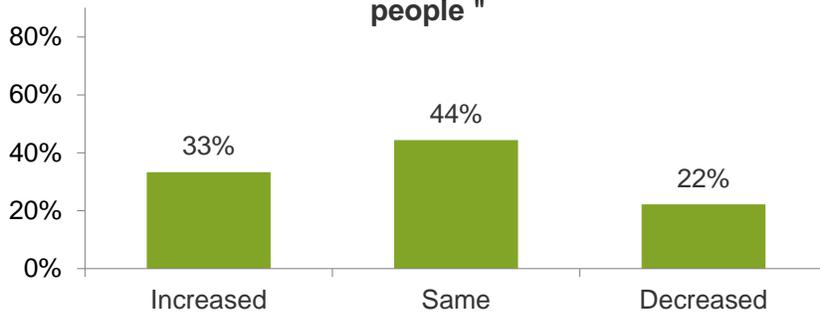


Figure 15. Pre-Post Change in Responses to "Engineering is about solving problems to help people "



N =27

Wilcoxon Signed Rank Test (2-tailed), Z=-1.128, p=.259
 Statistically significant when p<.05

Awareness of engineering careers

The post-program survey asked respondents to name three engineering careers. Only five of thirty respondents (17%) were able to name or describe three careers, while more than half (55%) did not name or describe a single career (See Table 4).

Table 4. Responses to: "Can you think of three different types of engineering careers/jobs?"

Response Category	% of Responses (N=30)
Named 0	55%
Named 1	3%
Named 2	24%
Named 3	17%

Among the responses that successfully named or described engineering careers, few used vocabulary that would effectively convey an engineering career to those unfamiliar with DOW.

"Fixing the middle of the road."

"Making crazy stuff."

"Traffic engineer."

"Salvar personas [con] tecnología." ("Save people [with] technology.")

"Industrial engineer."

"Make robotic body parts."

"Fixing electronics."

"Make electronics to help problem-solving."

“Marine engineer.”

“Cars and computers.”

“Technology engineer.”

Still other respondents included non-engineering careers in their responses.

“Police.”

“Maestra.” (Teacher)

“Surgeon.”

“Mechanic.”

“Doctors.”

“Paramédica.” (Paramedic)

Some respondents described engineering activities or aspects of engineering instead of or in addition to naming careers:

“Helping others.”

“Inventan cosas, arreglan cosas, trabajan mucho.” (“Invent things, fix things, work a lot.”)

“Engineers, they build machines and help people with problems.”

“Designing.”

Focus group participants seemed to understand that there are many different kinds of engineers although they weren't able to name many different types. Two participants mentioned biomedical engineers several times and noted that they wanted to become biomedical engineers. This appeared to be related to the surgery activity in the DOW program in which girls designed tools for a surgeon. One participant commented about the activity, “It made me have a strong passion for being a biomedical engineer.” The participants, however, also seemed to view the OMSI staff as engineers, which indicated that they had not grasped the difference between doing engineering activities and being a professional engineer.

The OMSI staff debrief forms also revealed a lack of understanding among the girls about engineering careers. On one form, staff wrote that the girls were able to make some connections during the engineering card example in Session 1, but only with strong framing from the OMSI team. On another form, the team noted that the girls did not grasp what biomedical engineers do. Staff also noted that the girls didn't seem to grasp the specifics of what a visitor did in her work as an engineer. Following another session that included a visiting

female engineer, staff wrote that they were unsure if the girls were able to make deeper connections to a conversation about engineering careers. At the end of the program, the OMSI team wrote that they did not know whether the girls had linked program activities to engineering careers.

Enjoyment of engineering skills and activities

Respondents were asked to rate their level of enjoyment of science, technology, engineering, and math at the beginning of the program and at the conclusion of the program. No significant differences were observed when comparing matched pre- and post- responses.

In the pre-program survey, respondents reported relatively high levels of enjoyment of science and technology, with more than two-thirds of respondents reporting that they enjoyed these subjects “a lot” (70% for science, 67% for technology) (See Figures 16–19).

Figure 16. Pre-Program Survey Responses to: "How much do you enjoy the following subjects?" for Science

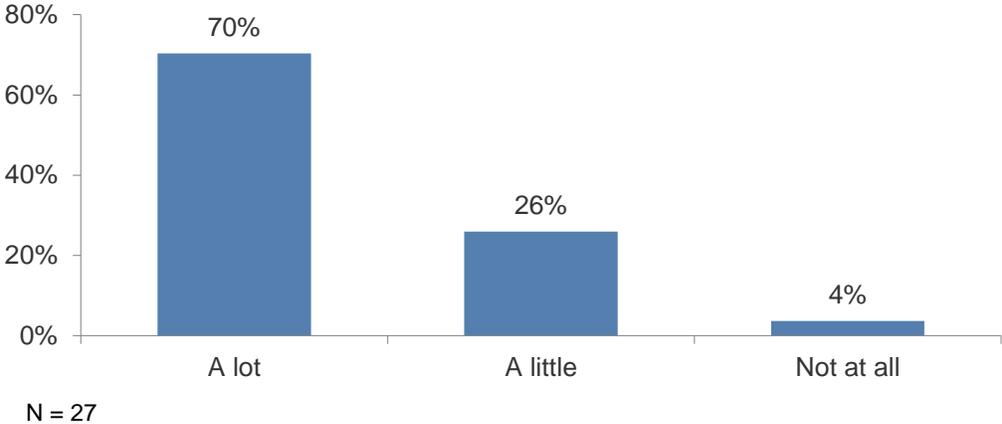
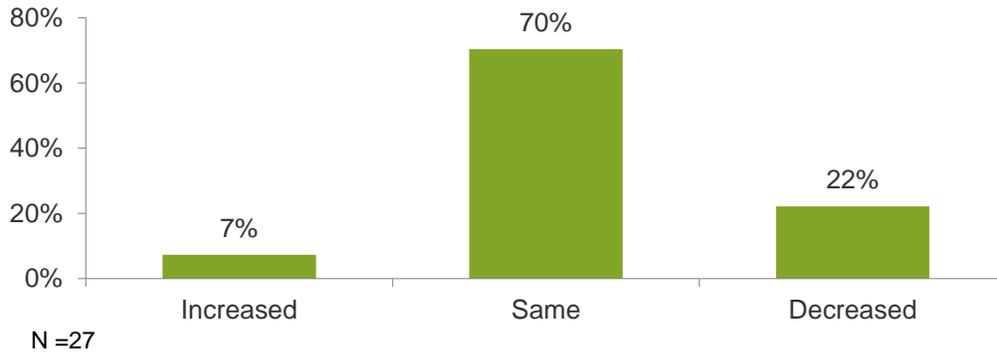


Figure 17. Pre-Post Change in Science Enjoyment



Wilcoxon Signed Rank Test (2-tailed), $Z=-1.414$, $p=.157$
 Statistically significant when $p<.05$

Figure 18. Pre-Program Survey Responses to: "How much do you enjoy the following subjects?" for Technology

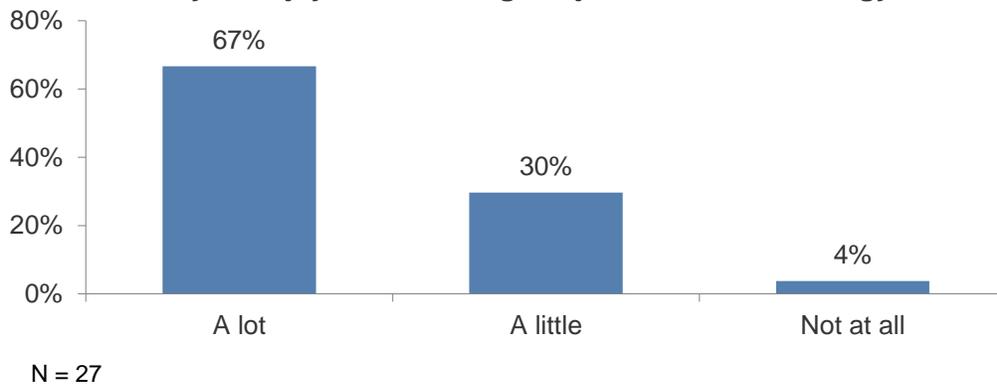
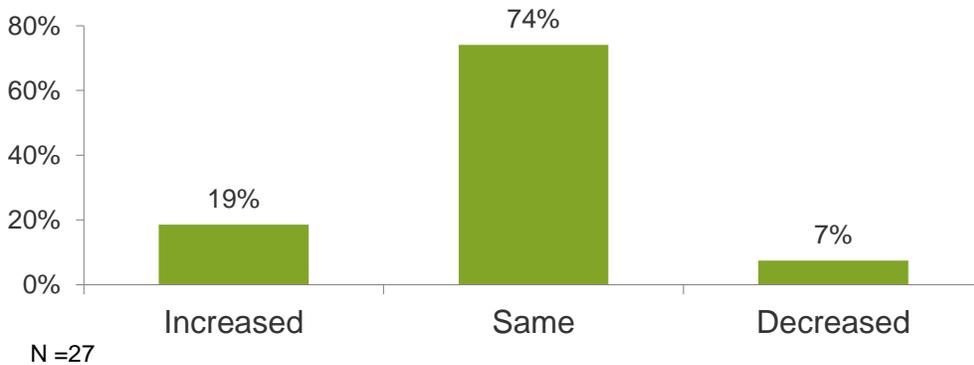
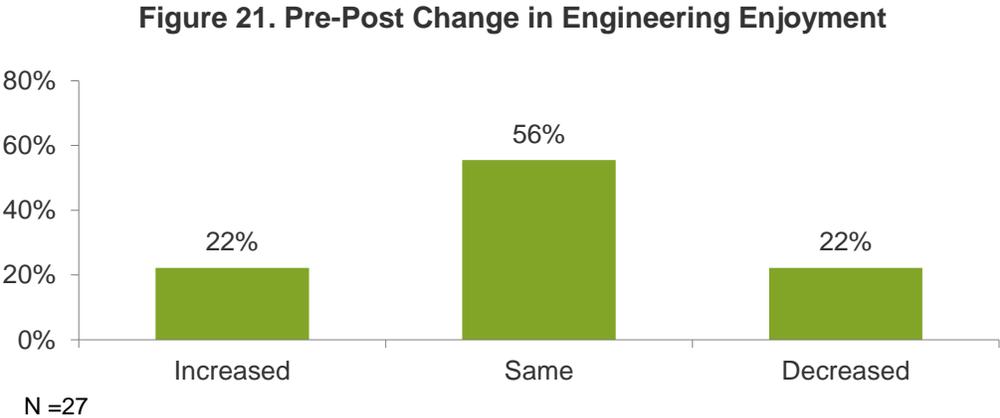
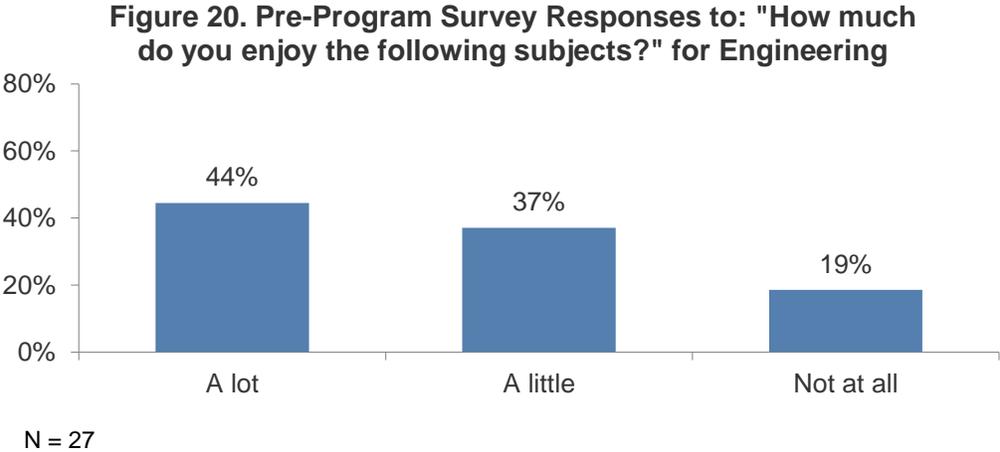


Figure 19. Pre-Post Change in Technology Enjoyment



Wilcoxon Signed Rank Test (2-tailed), $Z=-1.265$, $p=.206$
 Statistically significant when $p<.05$

In contrast, fewer than half of respondents reported in the pre-program survey that they enjoyed engineering and math “a lot” (44% for engineering, 41% for math) (See Figures 20–23).



Wilcoxon Signed Rank Test (2-tailed), $Z = -.243$, $p = .808$
 Statistically significant when $p < .05$

Figure 22. Pre-Program survey Responses to: "How much do you enjoy the following subjects?" for Math

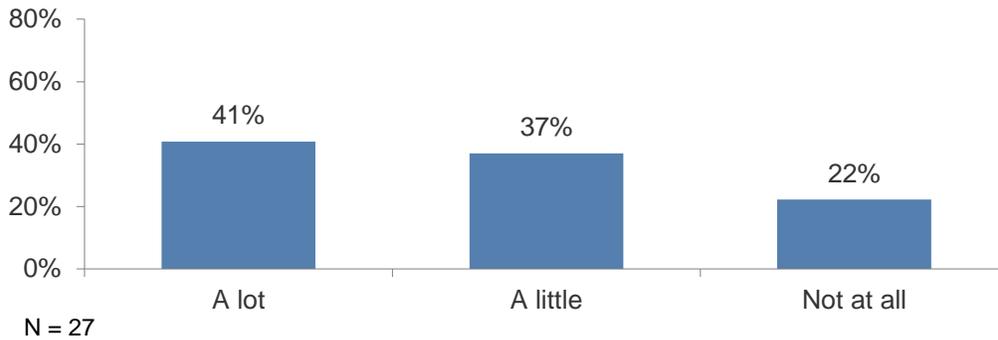
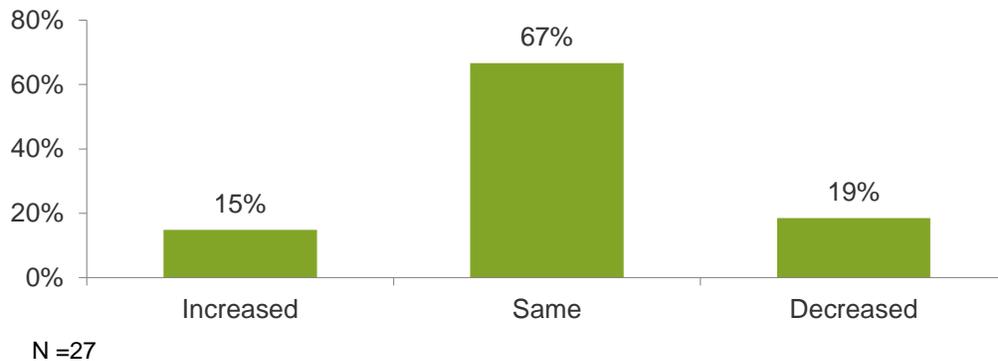


Figure 23. Pre-Post Change in Math Enjoyment



Wilcoxon Signed Rank Test (2-tailed), $Z = -.333$, $p = .739$
 Statistically significant when $p < .05$

The surveys also included an item that explored enjoyment of teamwork (See Figure 24). The vast majority of respondents (89%) agreed in the pre-program survey that it is fun to be part of a team. No significant differences were observed when comparing matched pre- and post-responses (See Figure 25).

Figure 24. Pre-Program Survey Responses to: "It's fun to be part of a team"

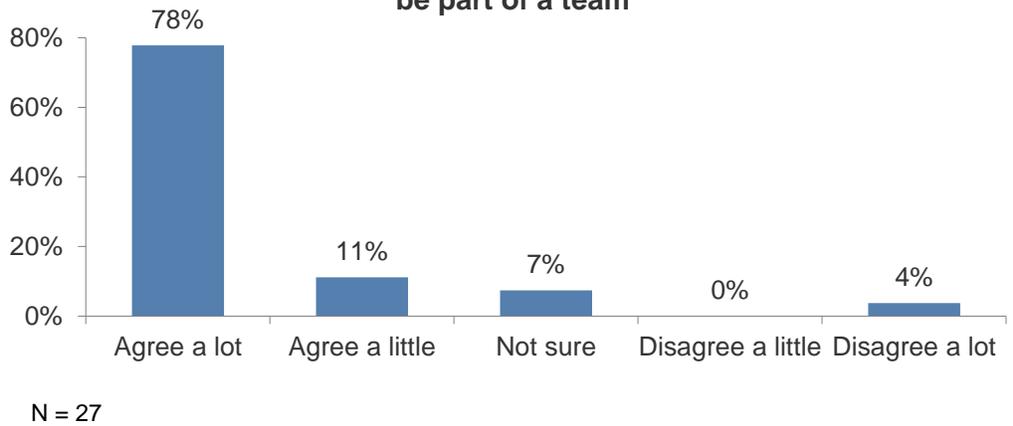
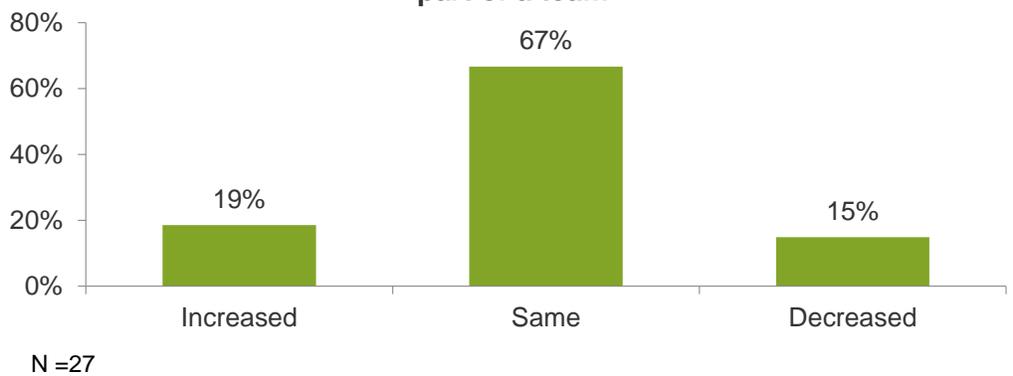


Figure 25. Pre-Post Change in Responses to "It's fun to be part of a team"



Wilcoxon Signed Rank Test (2-tailed), $Z = -.491$, $p = .623$
 Statistically significant when $p < .05$

Self-efficacy related to engineering skills and activities

The surveys included two items intended to measure girls' self-efficacy related to engineering skills and activities. No significant differences were observed when comparing matched pre-survey and post-survey responses to these items. In the pre-program survey, 81% of respondents agreed that they could come up with creative ideas and nearly three quarters (74%) understood how to solve problems (See Figures 26–29).

Figure 26. Pre-Program Survey Responses to: "I can come up with creative ideas"

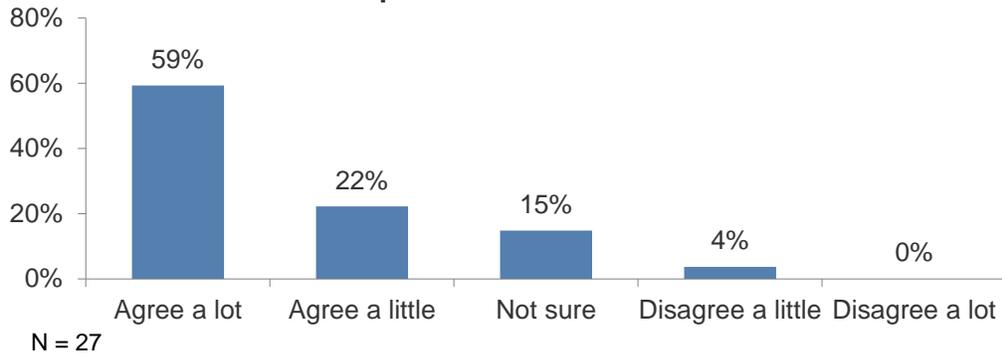
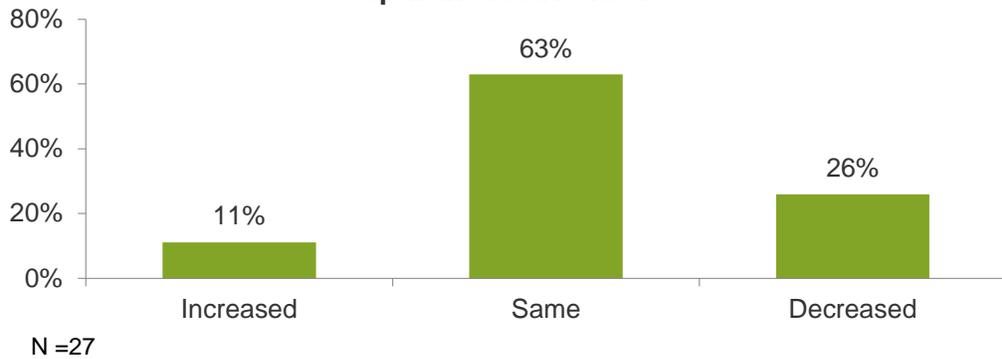


Figure 27. Pre-Post Change in Responses to "I can come up with creative ideas"



Wilcoxon Signed Rank Test (2-tailed), $Z = -1.265$, $p = .8206$
 Statistically significant when $p < .05$

Figure 28. Pre-Program Survey Responses to: "I understand how to solve problems"

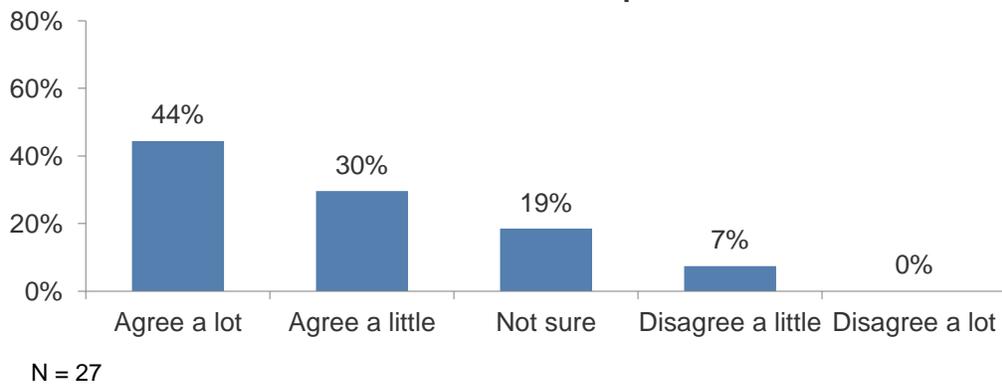
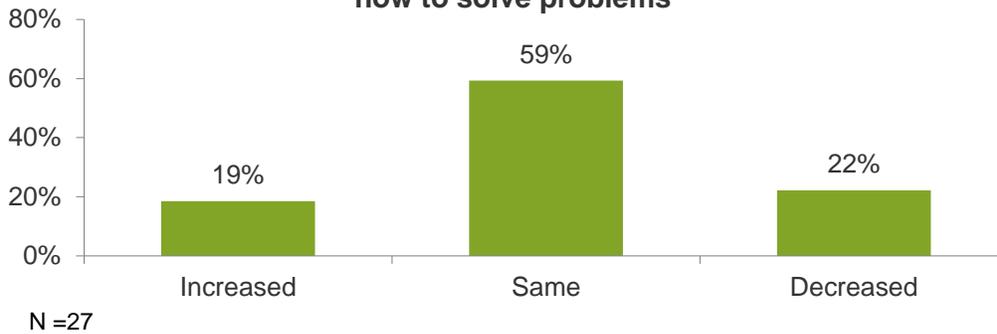


Figure 29. Pre-Post Change in Responses to "I understand how to solve problems"



Wilcoxon Signed Rank Test (2-tailed), $Z = -.631$, $p = .528$
 Statistically significant when $p < .05$

Attitude toward engineering

Finally, the surveys explored girls' attitudes toward engineering by asking respondents whether they felt engineering was important to their lives. In the pre-survey, about three-quarters of respondents (75%) agreed that engineering was important. No significant differences were observed when comparing matched pre- and post- responses (See Figures 30 and 31).

Figure 30. Pre-Program Survey Responses to: "Engineering is important to my life"

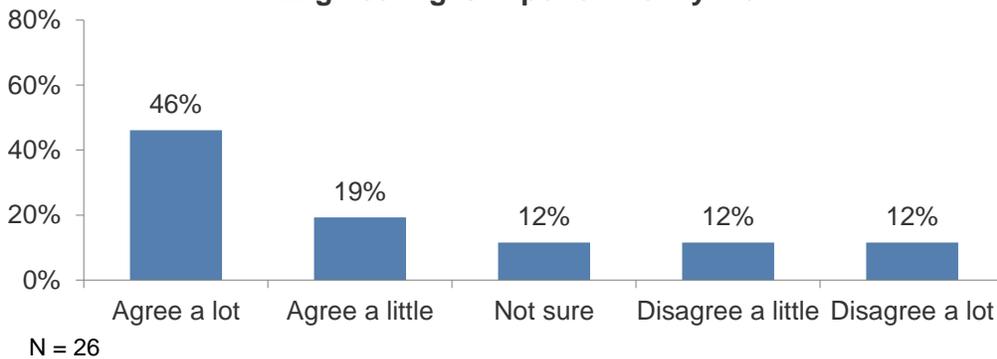
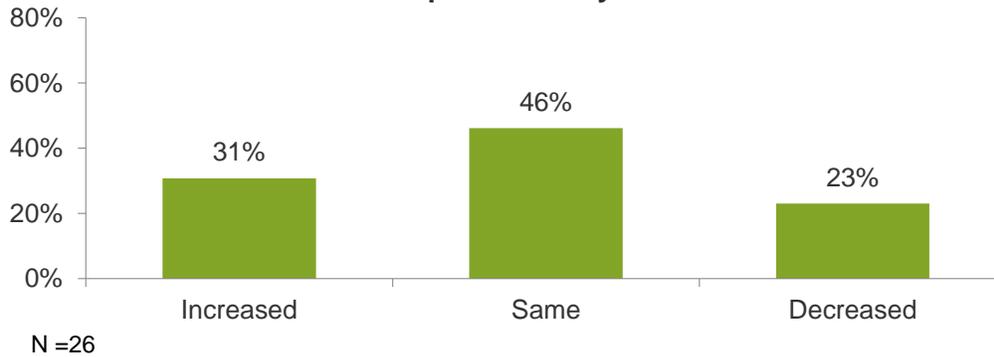


Figure 31. Pre-Post Change in Responses to "Engineering is important to my life"



Wilcoxon Signed Rank Test (2-tailed), $Z = -.414$, $p = .679$
 Statistically significant when $p < .05$

Nine of fourteen focus group participants said engineering was important to their life and offered several reasons. The other five participants said that “maybe” engineering was important.

“Porque puede hacer un robot que hace ice cream y ayuda en la casa a hacer comida.”
 (“Because you can make a robot that makes ice cream and helps making food at home.”)

“Because you can make a new creation.”

“It’s fun and we can make new and better creations and stuff to help people like the zipline one.”

“It’s boring but it’s important for life.”

“To inspire other people to be engineers and help people.”

“Because you can build stuff.”

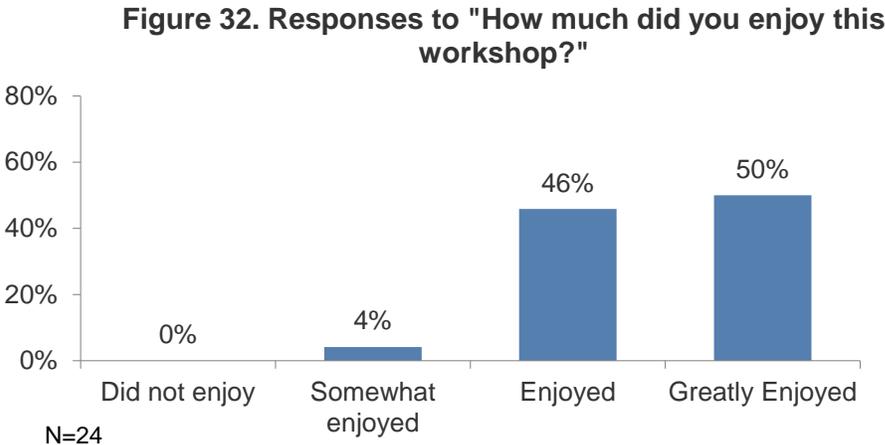
Results: Caregivers



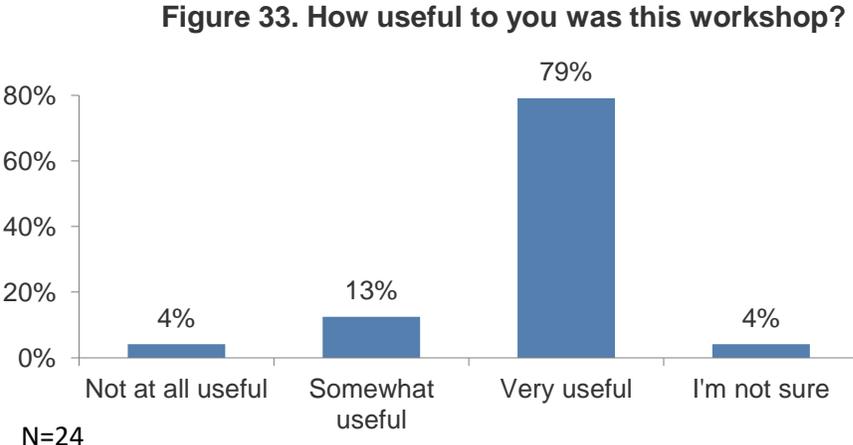
Results: Caregivers

Enjoyment and usefulness of workshops

The large majority of respondents (96%) reported that they enjoyed or greatly enjoyed the workshop they attended (See Figure 32).



The majority of workshop respondents (80%) found the workshop very useful (See Figure 33).



Increases in respondents' awareness and value of engineering

The majority of respondents (19 of 24 respondents) reported that the value that they place on engineering increased “a lot” as a result of the workshop. Additionally, nearly three-quarters (17 of 24 respondents) reported that their awareness increased “a lot” regarding the limited participation of women and girls in the fields of science and engineering. About two-thirds (16 of 24 respondents) also reported increased awareness of the different careers that exist in engineering (See Table 5).

Table 5. Responses to items about value and awareness

	Not at all	A little	A lot	I'm not sure
As a result of this workshop, how much did the value you place on engineering increase? (N=24)	2	3	19	0
As a result of this workshop, how much did your awareness increase that in the fields of science and engineering, women and girls' participation has been limited? (N=24)	2	4	17	1
As a result of this workshop, how much did your awareness increase of the different careers that exist in engineering? (N=24)	2	4	16	2

Supporting girls in engineering

More than three-quarters of respondents surveyed (18 of 23 respondents) reported that the workshop helped them “a lot” in learning about ways to support their daughters in engineering. The majority (20 of 24 respondents) also reported that the workshop helped them feel more confident in supporting their daughters in engineering (See Table 6).

Table 6. Responses to items about supporting daughters

	Not at all	A little	A lot	I'm not sure
How much did this workshop help you learn ways you can support your daughter(s) in engineering? (N=23)	2	3	18	0
How much did this workshop help you to feel more confident in your ability to support your daughter(s) in engineering? (N=24)	2	2	20	0

When asked to name a specific strategy to support their daughter(s) in engineering, however, only one third of respondents (33%) could do so. This suggests that the workshops may not have effectively communicated, to participating caregivers, specific strategies for supporting their daughter(s) in engineering. Caregivers who did cite strategies mentioned positive messaging to girls about their abilities, encouraging persistence, allowing girls to fail, and challenging bias by using inclusive language and positive feedback.

“To struggle with things until she figures them out instead of jumping and solving it for her.”

“Encourage girls with positive feedback, etc.”

“Explore, let them have a voice. Let them get dirty and let them take things apart.”

Respondents were also asked what they valued most about the workshop. Among the things they cited were discussing expectations for females, learning that women can work in the same fields as men, and discussing how to motivate their daughters. Respondents also said the discussion and sharing what happened during the workshop was valuable, and that they felt that the information was useful and eye-opening. They noted that they appreciated the strategies discussed and the handouts that they received. Respondents also said they valued learning more about science and STEM through the workshop as well as the information shared about college and scholarships.

“Que la mujer se puede desarrollar en áreas de campo igual que el hombre.” (“That women can also develop [careers] in the same fields as men.”)

“Having a person that truly wants to talk with us.”

“Personal anecdotes that underlined teachings.”

When asked for suggestions to improve the workshop, respondents requested more frequent workshops and bringing more speakers to address them. Others noted that receiving resources and tools to help them mentor their daughters would be helpful. Some respondents commented on the format of the workshop; they asked that the goals of the workshop be introduced at the beginning and that there be more time for interaction and questions from caregivers. One respondent commented that they were looking for more specific examples to assist them in helping their daughters.

“Suggest resources for activities/mentors, etc. to help with keeping girls engaged.”

“Maybe a little less talking, focus on engaging parents more.”

“Maybe tools such as calendar for meeting points, general resources that might be beneficial to girls and their families.”

“Todo estaba bien, y mucha información.” [“Everything was good, and there was a lot of information.”]

Values and issues important to caregivers

Focus group participants held strong commitments to education, personal growth, and career opportunities for their girls, and those commitments had led them to enroll their daughters in Adelante Chicas. Overall, participants highly valued Adelante Chicas for offering their daughters opportunities to try new things, helping them to develop social skills and life skills. Parents also commented on the importance of the strong leadership and mentoring of the after-school program.

Some participants shared the positive effects the Chicas program had had on their daughters, including for example, that girls had developed self-confidence through their involvement with the after-school program:

“Ahora va adelante con más confianza en sí mismo.” (“Now, she goes forward with more confidence in herself.”)

“Era una niña muy callada, con pocas amigas. Ahora es más activa, tiene más conocimiento. Le gusta mucho hacer preguntas; antes, no.” (“She used to be a very quiet girl with few friends. Now she is more active, she has more awareness. She likes to ask a lot of questions, unlike before.”)

Caregivers reported that they encourage their daughters in many ways, including offering them emotional support, motivating them, encouraging them to explore and participate in new things, recognizing their efforts, asking questions, and making sure they get to and from their activities.

“Pues apoyarla y motivarla...[Le digo que] participando es como uno va aprendiendo, y haciendo preguntas de lo que uno no sabe...” (“Well, supporting her and motivating her. [I tell her that] participating is how you learn and asking questions about what one doesn’t know.”)

“Yo la animo: ‘Sí tú quieres, lo puedes.’” (“I encourage her. ‘If you want it, you can do it.’”)

“Es lo que yo siempre—cuando regresan [les pregunto]...¿Cómo les fue, qué hicieron, quién y quién vino, de qué hablaron?” (“That’s what I always—when they return [I ask]... ‘How did it go? What did you do? Who came? What did they talk about?’”)

“Y también el apoyo el venir a traerla a la clase [de Chicas] y recogerlas y estarlas motivando para que ellas pues puedan un día también tal vez puedan tener un trabajo como [las personas en Adelante].” (“And also bringing them to class [for Chicas] and picking them up and continuing to motivate them so that perhaps one day, they too can have a job like [the staff at Adelante].”)

Parents talked specifically about encouraging their daughters to think about their interests, particularly in considering their future and careers. Some commented that their goal was to help their daughters discover their own interests regardless of what field it was and to then support girls in pursuing those interests.

“Habla ya ella que quiere ser veterinaria...Le digo ‘Pues sí, hay que estudiar para—vas a poder, si tú quieres un día se va a poder.’” (“She talks about wanting to be a veterinarian. I tell her, ‘Well, yes, you need to study for—if you want it you can do it.’”)

“Le digo [cuando hablamos de carreras] ... si es algo que te gusta...cuando algo te gusta, lo vas a hacer mejor.” (“I tell her [when we talk about careers]...if it’s something you like...when you like something, you will do it better.”)

“Lo más importante es mirar lo que ellas están visualizando—en lo que ellas más se enfocan. En lo que ellas están pensando. Entonces yo creo que ahí uno como padre apoyar su decisión de ellas...Ahorita a la edad de ellas [tienen], ya empiezan a pensar a la mejor en algo, pero todavía no es muy claro. Entonces si ya uno como padre les va preguntando, ‘¿Y qué te gustaría hacer?’, y ellas no tienen todavía unas respuestas claras pero sí, uno como padre motivarlas a que ellas vayan visualizando lo que ellas van a estudiar para el futuro.” (“The most important is seeing what they are visualizing—what they are most focused on. What they are thinking. Then, that’s where I think as a parent you support their decision...Right now they are at an age where they are starting to think about maybe something, but it’s not very clear to them yet. So then one as a parent starts asking, ‘What might you like to do?’ and they aren’t yet going to have clear responses, but as a parent one motivates them so they can start visualizing what they might want to study for the future.”)

Participants also reported that parents in their community actively support one another. For example, one participant shared that because she does not drive, another parent offered to drive her daughter home from the after-school program meetings. In another instance, the community held a bake sale to raise money for a girl to attend college.

Caregivers indicated that they wanted to have a deeper understanding of how to engage with their daughters around the day-to-day details of their daughters’ education. In order to do that, they said they wanted to know what skills their girls were learning and what ideas they were exploring.

Caregivers' understanding of DOW

Focus group participants were aware of, and had positive regard for, the DOW program. They had, however, little understanding of what the program entailed. Caregivers said they knew DOW had something to do with science and with exploring possible careers in science and a couple did mention engineering. Some also reported that their daughters were learning problem-solving and doing experiments.

“Ellas experimentan y que crean cosas, hacen proyectos. Tienen que que pensar en como hacerlo, para solucionarle el problema.” (“They experiment and create things, do projects. They have to think about how to do it so they can solve the problem”)

“Creo que me dijeron que era para informarles de las oportunidades—de ingeniería de o de ciencias o de computación. Es para su futuro.” (“I think they told me it was about informing them of opportunities—engineering or sciences or computing. It’s for their future.”)

“Creo que yo escuché algo de eso la otra reunión que venimos, que vinieron personas, y estaban hablando de eso—de las niñas—que como trabajos que casi sólo los hombres los realizan y que están involucrando también a las chicas.” (“I think I heard something at the meeting we attended, that people came and were talking about that—about girls—like jobs that almost only men do and trying to also involve girls.”)

Caregivers felt DOW was good for their daughters and was an educational quality program (in large part because of the trust they had in Adelante), but were unclear about the exact goals and specifics of the program.

One parent, for example, shared that her daughter came home excited about an activity she did that involved surgery and that her daughter had talked about that as a possible career. The parent said she appreciated that about the program and said she would encourage and support her daughter in that pursuit in whatever way she could. (Note that the caregiver did not realize her daughter was actually interested in an engineering-related career.)

As noted earlier, caregivers placed high importance on their daughters' education and overall development. They were clearly involved with their daughters and were already supporting them in many ways.

When evaluators asked respondents what they thought about workshops, participants liked the idea of learning more about what their daughters were engaging in, largely because they emphasized they try to support their children's endeavors. Some mentioned they are already involved in the school and thought discussion groups or workshops could be useful in their own learning. A couple parents who said they worked at home said they already attended some presentations and discussions for parents.

While parents were receptive to the idea of workshops, many of them have work schedules and/or long work hours that make it difficult for them to *attend* the workshops. Parents (and Adelante staff) shared that they work shift jobs, meaning that they are not necessarily available when workshops were offered. Some also work in agriculture, requiring early morning starts and long hours, which made for long days. Those that worked in agriculture also had to first head home to clean up (especially as they were exposed to chemicals), meaning they could not head to workshops immediately following work. One respondent explained:

“Depende del horario —salgo a las 5 [del trabajo]. Los talleres empiezan a las 6. Es difícil. Trabajo desde las 4 de la mañana. Tengo cansancio.” (“Depending on the schedule—I get out [of work] at 5. Workshops start at 6 [pm]. It is difficult. I start work at 4 a.m. I’m tired.”)

Adelante staff shared that they do hold workshops for their programs so that it is doable for some parents, but that given work and weekend schedules, holding programs later in the evening (even 30 minutes later than when the DOW workshops started) and later in the week—on Thursday or Fridays—rather than earlier in the week might be more successful. They also commented that having parents sign up for a date rather than leaving it as an open invitation where they could drop in on one of two workshop dates could also help with turnout.

For caregivers who said attending workshops was challenging, some suggested that perhaps the program could create written materials in Spanish for parents to help keep them informed of the program and what their daughters were doing and learning. They felt this information could keep them updated and help them engage their daughters in conversation about program activities, what interested them, and in supporting them around their learning.

“Yo me inclino por [algo] escrito porque sería una idea más mejor para la personas que estamos trabajando y no podemos asistir al taller. Se les informaría por medio un paquete escrito.” (“I’m inclined toward [something] written because it’d be better for those of us who work and who can’t attend the workshop. You’d inform them through a written packet.”)

Caregivers also valued activities that involved their entire family and few respondents also described the importance of the school/Adelante community, suggesting that group events or efforts are important. One person, for example, suggested an end-of-the-year expo to see the projects that their daughters had been doing in DOW and would be a way to celebrate their daughters’ accomplishments. Other parents weighed in, saying that they really liked that idea.

Caregivers’ perceptions of OMSI

Participants were enthusiastic about OMSI and a number of them shared that their daughters had enjoyed their visit there as part of their Chicas experience.

“Ella pensaba que eran iguales [todos los museos], pero descubrió que [OMSI] era diferente. Y no quería salir. Estaba jugando. Puede trabajar más su capacidad.” (“She thought that [all museums] were the same, but she discovered that OMSI was different. And she didn’t want to leave. She was playing. She was able to engage at her own level.”)

“Sí fue, ella solamente [a OMSI]...Se enfocó en lo que es ciencia.” (“Only she went [to OMSI] and she focused on what is science.”)

Although they did not recall a lot of details, they did see the outing as educational. (Some caregivers wanted to know more about OMSI and some wondered whether it was dedicated solely to science or if it had other kinds of content as well.)

Only a few respondents had visited OMSI themselves, but those that did said they enjoyed their visit. Some, however, did share challenges. Specifically, they commented that it had been difficult to negotiate the visit to OMSI because there was little to no material or information available in Spanish. A few commented that they like to have Spanish-speaking guides for their visit that could explain the exhibits.

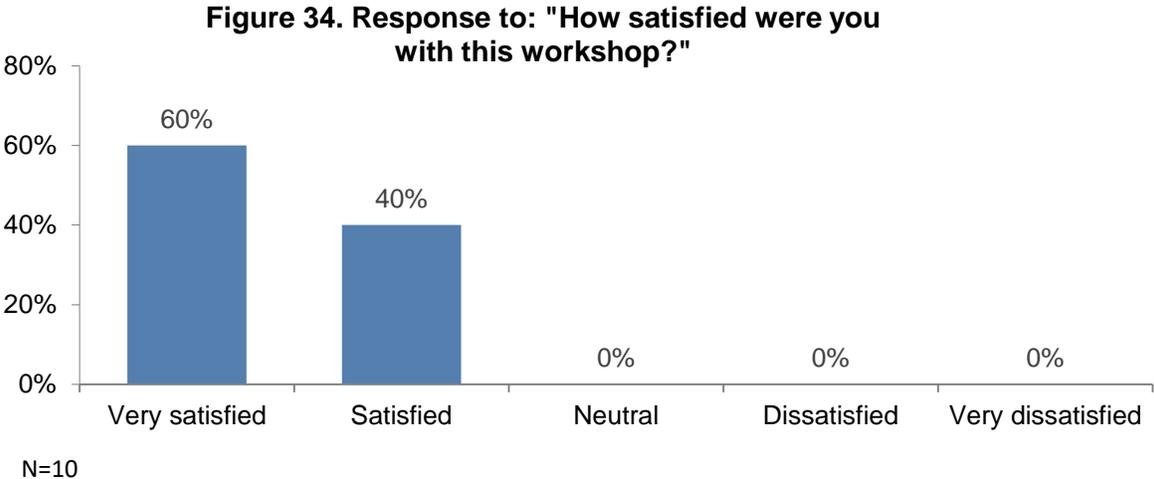
Results: Staff



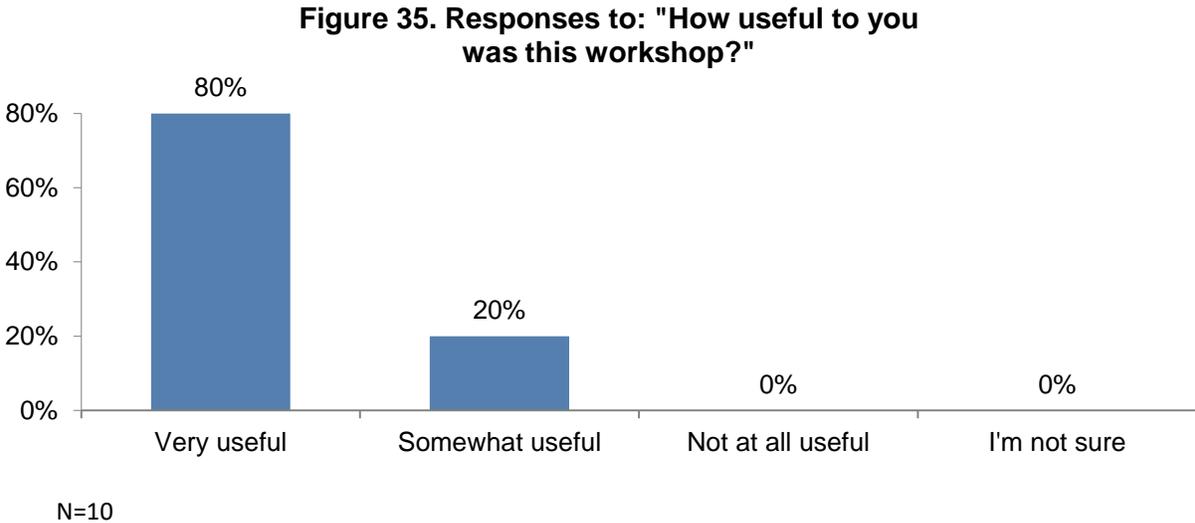
Results: Staff

CBO staff

Staff from Girls, Inc. and Adelante who participated in workshops reported high levels of satisfaction, with 60% indicating they were “very satisfied” and 40% saying they were “satisfied” (See Figure 34).



The vast majority of respondents also found the workshop useful, with 80% rating it as “very useful” and the remaining 20% rating it as “somewhat useful” (See Figure 35).



Staff noted that opportunities to see and try hands-on activities were especially useful, providing concrete examples of how girls could be supported to engage in engineering-focused pursuits. They also cited the presentation and discussion as useful.

“Trying out some of the engineering activities that we can potentially use with our girls in the Eureka! program.”

“The opportunity to practice hands-on activities and learning about the importance of equity in getting more girls involved.”

“The equity power point and discussion. It was a good moment to have an open-ended discussion on the strategies of equity in delivering sessions around engineering. Also, hands-on experience for the educators!”

“The project activities were great ideas.”

Workshop participants also reported slight increases in their awareness of gender inequity in engineering and that careers in engineering were an option for girls. (OMSI staff reported that most workshop participants were already doing some work in STEM, so perhaps that may explain why respondents reported lower levels of influence on their awareness about engineering inequity and engineering careers as options for girls.) We saw a more solid increase in the value they said they placed on engineering as a result of the workshop and in learning about ways to make engineering relevant to girls (See Table 7).

Table 7. Responses to items about engineering

	Not at all	A little	A lot	I'm not sure
As a result of this workshop, how much did your awareness increase that in the fields of science and engineering, women and girls' participation has been limited? (N=10)	1	5	2	2
As a result of this workshop, how much did your awareness increase that engineering can be an accessible career option for girls? (N=10)	0	5	3	2
As a result of this workshop, how much did the value you place on engineering increase? (N=10)	0	3	7	0
How much did this workshop help you learn ways to make engineering relevant to girls? (N=10)	0	1	9	0

Participants clearly valued the opportunity to engage in conversation with other professionals about issues related to engineering and science. Additionally, the workshop seemed to have most impact in providing concrete strategies participants could take away for making engineering relevant to girls. When asked about strategies learned, respondents shared a number of ideas:

“Having open-ended activities, using altruism and personal stories. The activities today were fun!”

“Inclusive language. Talking = stereotyping threats. Open-ended experiments.”

“It is not a boy thing and it could be fun. You can collaborate too.”

“I think providing the girls with examples of women engineers and scientists is a great way to help them see how they can be part of the ‘STEM world.’”

“I learned tools to help explain to girls why they feel the “chilly climate,” I learned to connect materials to their lives.”

“Researching female engineers and finding role models or mentors that are in the field but also can relate to the students we work with.”

“Threat stereotype. How to engage girls in STEM (strategies). Using more inclusive language.”

Overall, workshop survey results indicate the workshops were very effective for participating CBO staff.

Consistent with Year 2 formative evaluation findings, qualitative data indicated that the embedded PD model resulted in the most positive outcomes for those few staff directly involved in program implementation. A couple respondents, for example, talked about how valuable it was to observe OMSI staff model ways to engage girls as well as families:

“The observation of the Chicas [program helped me] to learn how to introduce the topic to youth. And we noticed that it was very open-ended.”

“We are used to doing tons of activities with the girls and some are on STEM, but not necessarily with families with that particular topic [of engineering]. So for me, just getting an idea on how to facilitate STEM-related workshops with families and how to introduce the engineering or STEM topics to families [was useful].”

Staff not directly involved in the DOW sessions were definitely on board with the program and the opportunities to engage girls in science and especially valued the hands-on focused curriculum. They were, however, less able to describe the specifics of the program or strategies (other than to say it was “hands-on”) for engaging girls in engineering. These respondents tended to talk about the project in broader terms and sometimes focused most on the lessons learned around program coordination and logistics. At Girls, Inc., it was especially noteworthy that staff tended to talk about DOW as generally being about STEM and rarely discussed the program specifically in terms of engineering.

Additionally, although the PD workshops involved a larger number of CBO staff with documented positive outcomes, these brief offerings were conducted at the end of the DOW cycle. As a result, an opportunity was lost to use the workshop to communicate broadly about DOW across the organization. In addition, CBO staff could only attempt to apply what they learned after the DOW program had already been completed.

Reflective discussions with partner CBO staff were introduced in Year 3 as part of the DOW research activities. Staff who participated in reflective discussions with the OMSI team indicated that the dialogues helped them explore and reflect on girls' engagement. They noted that discussing girls' interactions was especially useful and also appreciated hearing about OMSI's research project on girls and engineering and what they were learning:

"Those sessions were really enlightening for us and really nice for us to spend that time in that kind of professional development setting with other youth development practitioners and really, you know, reflect and evaluate and think about what is actually happening in the program and they shared some really great perspectives—you know, some kind of a research-based perspective that we don't often get to hear as program-based folk. So that was really lovely and it was excellent to have that time with them."

"They were mostly around reflection... [and we'd discuss] scenarios from—that had actually happened in the group [with girls] and think about, okay, why did Girl A react this way and why did Girl B do this?"

These reflective sessions also meant more staff could participate beyond those who were involved in the onsite implementation of the DOW program. These type of reflective sessions offer a promising direction for involving more CBO staff and more deeply engaging them in issues of girls and engineering and reflecting on their own practice.

OMSI staff

The primary outcomes for OMSI staff involved in DOW were in learning ways to effectively engage girls in engineering-related programming. Specifically, they experimented with various hands-on activities, learned about what captures girls' interest and engages them, and tried to embed engineering design processes into activities.

"I feel like we learned a lot. Having the role models was super cool. Seeing what they were interested in and then hearing them remember this was super cool. We definitely saw that the altruism piece was good strategy. Adding people on the zipline got them thinking about lots of different factors and got them engaged."

They also gained insights into the practical aspects of implementing the program (e.g., figuring out ways to ensure delivery of solid content within the time constraints of sessions), what works and what doesn't, and how to adjust activities for girls at different age and skill levels.

“There was definitely a lot of difference in skill level with different groups. Not sure if this was age difference or something else. We found we had to adjust activities for different groups [at different sites]. It takes time to learn to work in a team. With [one partner site] we spent so much time addressing the team dynamics and not being able to work together. Whereas [at the other partner site] it was completely different.”

“Timing activities as way of motivating girls [didn't always work]. At [one site] that didn't seem like a good way to build confidence. So each group had their own level of how far we could take something and keep building confidence or motivating them.”

Staff members reported increased confidence in their ability to engage girls in engineering programming and in communicating with others about gender inequity in engineering, but said they were less confident at this point in their ability to work with organizations that serve multiple diverse communities.

“I do feel pretty confident in engaging them in activities and have yet to see a girl get bored with the engineering activity and skills. So I already had confidence in engaging in programs. But it's so much more that over the last few years that I've gained from the program. Presenting on gender equity, being able to talk about it—even with girls. That's big.”

“It depends on what community we are talking about [how confident I feel]. I don't feel as confident with organizations that serve multiple [diverse communities]...So I'd need to learn and [then] do the trust-building.”

Implementing the program at different sites also broadened staff members' understanding of what is needed to work with different community organizations. Staff were especially challenged by the differences between the CBO partners and the need to adapt—perhaps more than they anticipated—to the different contexts. Among the lessons learned cited were:

- The need to be flexible (“You have to plan it but then have five back-up plans for when everything changes”).
- Understanding the organizational structure and individual roles upfront to ensure the right individuals are brought into conversations and decision-making. Staff also cited the need to more clearly outline OMSI staff’s and partners’ roles, particularly in program delivery.
- The need to invest upfront time to build relationships with partner organizations. Staff noted that it took more time to develop those partnerships than they initially anticipated and that working with three different community partners—Adelante, Boys and Girls Club, and Girls, Inc.—at once was very challenging. One staff member noted that the well-established and long-term relationship with Adelante clearly showed a difference in the way the program worked there compared to the other two partners.
- The importance of building trust with partners was another important learning point. Staff again cited the existing levels of trust at Adelante which facilitated the entire implementation process. At other sites, staff had to build trust that the DOW program and content could augment their existing programming positively.
- The need to better understand partners’ organizational cultures and strengths, including better drawing on partner organizations’ skills sets and expertise. Staff also noted that a better understanding of CBO staff’s understanding of issues related to girls and STEM would have helped in informing the PD workshops.

OMSI program staff participated in a Team-Based Inquiry (TBI) process used as part of internal OMSI evaluation efforts. In the TBI process, the team reflected on how the program piece of the educational model worked to foster engagement with and knowledge about engineering. These efforts were important in reflecting on specific activities and target audiences’ engagement. However, although the PD design sets a separate goal of deepening learning for OMSI staff of how to work with a broad range of CBOs and engage diverse communities, the current PD design focuses only on CBO staff and does not explicitly define the mechanisms in place for supporting the OMSI DOW implementation team in its own learning and reflecting on their practice.

DOW Educational Model



DOW Educational Model

The OMSI team was also interested in understanding how the DOW model played out in the different community partner sites—particularly the factors that influence implementation in these settings. Given that the model was not the primary focus of the evaluation, we reviewed data collected for assessing outcomes to glean insights about potential factors. This included formative data from the Boys and Girls Club partnership for DOW as well as that from Adelante and Girls, Inc. Although many of the issues are already described in the previous sections of this report, we summarize additional insights below:

The program structure and focus at community partners affect how well DOW can be integrated into existing programming. Although all three sites focus on youth, their orientation and what they felt they needed from external programming was quite different. For example, the Boys and Girls Club (BGC) placed priority on creating a safe and positive environment for youth with many opportunities for youth to drop in and engage. Its relatively loose structure and many activities meant all youth did not consistently attend DOW activities, which was a challenge given that the OMSI team envisioned that youth would attend sessions regularly. For BGC, DOW's value was primarily around the hands-on nature and content, but it did not fit in as well with general structure of the Club or its programs. Similarly, the ways programs are run affect the degree to which specific aspects of the DOW program work. In particular, the emphasis on teamwork was more challenging at BGC and Girls, Inc. because programming at these partner sites was not normally structured this way.

Partner strengths and areas of expertise affect expectations for collaboration and perceptions of DOW. Although all partners valued OMSI and the DOW program, the perceived need for the program varied. At Adelante, staff noted that while they do have STEM as a focus, they were not versed in engineering content. They considered OMSI experts in informal learning and saw significant value in the program. At Girls, Inc., which already has an existing and strong national STEM program, there were questions for staff about the ways and extent to which DOW differed from what Girls, Inc. was already doing. Although this partner staff valued OMSI and its expertise, particularly in hands-on learning, they also added that they too had experience in STEM and in engaging girls. This partner expected a much more collaborative relationship in which the program developed drew strongly from both OMSI and Girls, Inc.'s expertise, and expressed disappointment that this was not the case. Additionally, they were concerned that

despite repeated requests, the DOW curriculum was never shared with them during development, which meant they were never able to weigh in on it. Although it is difficult to concretely document how this affected DOW at this partner site, it likely affected the level of trust with this partner.

The nature of relationships with parents significantly affects how caregivers engage in DOW. The DOW model assumes that all partner sites will have strong relationships with caregivers, which was not the case. Although Girls, Inc. and BGC have some relationship with caregivers, the main focus is youth. Only Adelante had more consistent communications with parents and existing parent programming. Thus, it was more difficult to communicate with caregivers (even on logistical pieces such as obtaining consents) at those sites where partners had less communication. Workshops were also more challenging for Girls, Inc. and BGC in terms of both recruiting and even identifying dates for PD sessions. (At BGC, no workshops were actually conducted.)

It is important to note, however, that even at Adelante only a few caregivers who attended workshops actually had girls in the DOW program. There appeared to be a number of reasons (e.g., different dates and times may have worked better for some, there were challenges in caregivers' work schedules). It also appeared that those adults attending OMSI visits did not necessarily have girls in the DOW program. It appears that the DOW model, as envisioned with multiple touch points (initial orientation, PD workshops, family engineering nights) for caregivers of girls in the DOW program, is challenging to implement in different community contexts.

The nature of the existing relationship with a community partner greatly affects program implementation and success. As noted previously in the section on staff learning, the relationship between partners is a major factor in the success of DOW implementation. The program appeared to be most successful at Adelante, where OMSI staff had a strong existing relationship with the CBO, had developed high levels of trust, and was already knowledgeable about the existing community. The importance was clearly underscored of spending significant upfront time to learn about a partner's values, strengths, and needs, organizational structure, and nuance of how it structures its own programs.

Conclusions



Conclusions

This study found that DOW achieved some of its target outcomes for its target audiences in Year 3. We summarize findings by audience below.

Girls

The participating girls were highly engaged in DOW activities. For the vast majority of sessions (86%), staff reported that all of the girls actively engaged in the activities and nearly all survey respondents (93%) reported enjoying the program. Overall, survey respondents and focus group participants reported enjoying and remembering the activities. Some focus group participants, however—specifically the fifth-grade girls—reported that aspects of DOW were not sufficiently engaging or challenging. Additionally, some girls said they would like more time to complete the activities. The visits from female engineers were particularly memorable for the girls, but the girls did not seem to have a clear understanding of what the engineers did. In addition, the girls did not distinguish between OMSI staff and the visitors, describing all of the adults related to the program as engineers. Finally, nearly all the focus group participants reported that the research-related video and audio recording that took place during DOW constrained their enjoyment of the program.

DOW sought to enhance girls' knowledge of engineering and engineering careers. Regarding the quantitative pre-program and post-program measures, no statistically significant changes were observed in items related to knowledge of engineering, which may be due in part to the ceiling effect observed with the assessment instrument that was used. At the conclusion of the program, however, many focus group participants were able to articulate the basic concepts of engineering, especially the altruistic nature of the profession. Survey respondents also described engineering as an altruistic and collaborative career, which suggests that the program successfully conveyed the social nature of engineering careers. In addition, several focus group participants demonstrated a more nuanced understanding of engineers and engineering. It also appears that girls' knowledge of and demonstration of collaboration was limited. Girls' knowledge of engineering careers also seemed limited. At the conclusion of the program, girls could describe engineering careers in general and engineering activities, although they largely lacked the vocabulary to name specific career options. Staff members also noted that girls did not grasp the nature of engineering careers or how those careers related to program activities.

DOW also sought to shift girls' attitudes about engineering. No statistically significant changes were observed, however, via the pre-program and post-program measures of engineering-related enjoyment or self-efficacy. This may be because the program was a relatively short-term and low-intensity intervention, while shifts in these constructs typically require long-term, high-intensity interventions. It is also important to note that respondents began the program with relatively high levels of enjoyment of science, technology and teamwork and relatively high levels of self-efficacy around creativity and problem-solving. It seems unlikely that DOW would raise these levels further. In contrast, respondents began the program with lower levels of enjoyment of math and engineering.

Finally, DOW sought to help girls develop a positive view of engineering. Respondents began the program, however, with a relatively high level of agreement that engineering was important and no statistically significant changes were observed at the end of the program. The end-of-program focus group did provide some insight into the ways in which participants saw engineering as important in their lives, noting that engineering could allow them to create things and help people.

Caregivers

The program model intended for the caregivers of DOW participants to engage in workshops that would build the knowledge, skills, and attitudes they need to support their girls in pursuing engineering careers. There was a disconnect, however, between the caregivers' and girls' components of the program, and few of the caregivers participating in the workshops actually had girls in the program. Those caregivers who did attend the workshops reported that they found them useful and that they felt more knowledgeable about and confident in supporting their daughters. They found the information to be eye-opening and particularly appreciated the strategies that were presented for supporting their daughters. Few participants (33%), however, were able to identify specific strategies that they had learned.

The focus groups conducted with caregivers of girls participating in DOW revealed the caregivers' high regard for both DOW and OMSI. Caregivers had a positive relationship with Adelante Mujeres and trusted that Adelante would partner with an equally credible organization. Caregivers had a general sense that DOW related to science but lacked a clear understanding of the program's goals and specifics. Overall, the caregivers were highly motivated and

engaged in supporting their daughters' education and were focused on the long-term trajectory of their daughters' career development. They requested information about what their daughters were learning through DOW and concrete strategies they could use to help extend their daughters' learning. Since many caregivers worked very long hours and were unable to attend workshops or other meetings, they requested written materials in Spanish.

Staff

DOW sought to develop CBO staff awareness of gender inequity in engineering and their knowledge and skills in making engineering relevant and accessible to girls. CBO staff who participated in DOW did, in fact, report increased awareness of gender inequity in engineering. They also reported that they had gained a better understanding about strategies to engage girls in engineering activities and that they felt they could use those strategies to engage girls in their organizations.

The embedded PD model provided strong learning and impact for the CBO staff members who participated in the DOW sessions. Impact on the CBO overall, however, was limited due to the small number of individuals participating in DOW and the high level of staff turnover. The PD workshops addressed this limitation somewhat through their larger reach across the organization. Their impact, however, was limited because the workshops served as a culminating piece of the program after DOW activities had concluded. The reflective discussions showed promise for engaging a larger number of CBO staff in a deeper conversation about the topics that DOW seeks to address.

DOW also sought to enhance OMSI staff's knowledge, skills, and confidence in making engineering relevant to girls. OMSI staff did report that they had learned ways to engage girls effectively in engineering-related programming. In addition, they gained insight about the practicalities of implementing the program at community sites and about what is required to collaborate effectively with community partners. They learned about the importance of understanding organizational strengths and cultures and investing time in order to build strong relationships and trust. Although this knowledge was not a target outcome of DOW, it does seem critical to program success.

In the initial DOW model, the development of OMSI staff was to be supported through a team of CBO staff, community members, and caregivers who would work together as a cohort to

advance the DOW vision. In Year 3, it appeared that no PD model for OMSI staff had been developed to replace this initial plan.

Evaluation Methods

In addition to illuminating the program's impact, this evaluation also shed light on the methods it employed. The strongest insight into girls' knowledge and attitudes was gained through the open-ended survey responses and the focus group data. Although the pre-program and post-program assessments were intended to measure knowledge and to capture changes over time, they did not perform as expected due to a strong ceiling effect for many items. The ceiling effect may have been due to the dichotomous nature of the instrument that, by nature, resulted in limited variability among responses. It could also have arisen if respondents had had prior exposure to the content or were able to deduce the desired responses. Going forward, a more sensitive instrument would be required in order to measure girls' knowledge and to capture changes in that knowledge. It may also be beneficial to expand the use of observations and interviews in conjunction with the assessment to understand girls' prior exposure to the target content and the ways in which they may be able to deduce the desired respondents. These qualitative methods may also illuminate additional aspects of girls' engineering knowledge and any changes in that knowledge that may occur between the pre-program and post-program assessment.

Quantitative methods were also employed to measure girls' attitudes about engineering. It seems unlikely, however, that statistically significant changes could be observed on these constructs over the short duration of the program. In addition, as noted above, the girls began the program with relatively positive views of engineering. Use of more in-depth individual or group interviews before and after their experience with DOW may be more useful in illuminating the changes, if any, that take place in girls' views of and attitudes about engineering over the course of the program.

Implications



Implications

The findings from the Phase 1 summative evaluation conducted in Year 3 present several implications for program design and evaluation going forward.

Target Outcomes

DOW had ambitious aims for affecting engineering-related knowledge, attitudes, and skills among girls, caregivers, and program staff. These target outcomes seem overly ambitious, given the relatively short-term and low-intensity intervention that the program delivers. In Year 4, DOW would benefit from focusing more narrowly on the constructs that it is most likely to influence. It seems likely that outcomes related to awareness and knowledge will be the most realistic targets for the DOW program. For girls, these constructs may relate to an understanding of engineering, awareness of the engineering design cycle, and/or knowledge of engineering careers. For caregivers, the most realistic target constructs may be those that relate to engineering careers, gender equity, and general knowledge of what their daughters are learning.

Program Design

Once a limited number of target constructs are identified and clearly defined, DOW would benefit from bringing greater intention and rigor to program design around those constructs. For the girls' programming, this would include clearly defining learning objectives related to selected constructs and then aligning program activities to achieve them.

For example, the DOW team might decide to focus in Year 4 on the target outcome of increasing girls' knowledge of engineering careers. If that were the case, the team would be encouraged to clearly identify the specific engineering careers it seeks to provide exposure to and the aspects of those careers that the program will convey. Program activities could then be aligned to clearly communicate about those careers by providing hands-on experiences and discussion of the key characteristics of those careers. In addition, visits from practicing professionals could be leveraged to help girls understand the type of engineering the visitors do and what skills they use in their work. It would be also important to define specific vocabulary that will be taught to the girls.

Similarly, if the team decides to focus on girls' understanding in engineering design process, it would be advisable for DOW to reduce the number of activities to provide sufficient time for girls to participate in an iterative cycle of design. This focus would also likely affect the program schedule as program dates would need to be structured to provide connection and carry-over across sessions. In addition, visits from female engineers and discussions during program sessions should be aligned to support and reinforce the engineering design process.

For caregiver programming, it will be important to address the disconnect between the caregiver and girls' components of the program that resulted in few workshop participants actually having girls in the program. It will also be important to consider the limited amount of contact that will be possible with caregivers and refine programming objectives and strategies accordingly as well as outcomes for this audience.

Caregivers are highly motivated and engaged in supporting their daughters and would benefit from specific, concrete information and strategies that align with the girls' curriculum. For example, if girls are learning about specific careers and vocabulary, caregivers could benefit from receiving a handout written in Spanish that shares a summary of the same information. This would equip caregivers with the tools to engage in conversations with their daughters to extend the learning. Similarly, caregivers might benefit from a Spanish-language handout for each of the girls' lessons that provides three questions they might ask their daughters in relation to the week's activity.

PD for CBO staff could also benefit from increased structure and focus in Year 4. If DOW seeks to have a broader impact on CBO staff, the program would need to extend participation to a greater number of staff through a wider variety of channels. One promising strategy is the PD workshops, which are designed to include a range of staff members. By rescheduling workshops to earlier in the program cycle, DOW can extend their influence and build momentum during DOW's peak period. Since the workshops are brief in duration, it also seems advisable that OMSI staff continue the reflective discussions introduced in Year 3. If the reflective conversations are intended to be PD rather than a more general and informal discussion, a structured approach will be required that includes clearly articulated goals for each session as well as specific strategies to accomplish those goals.

In Year 3, there were no formal DOW activities or components explicitly included to support OMSI staff PD outside of the TBI process used for internal evaluation. Going forward, the

program could benefit from putting a mechanism in place that allows staff to codify what they're learning, reflect, and adjust their practice. This could be accomplished through a process that includes content delivery and that helps staff members further reflect individually or as a team on their own practice. Staff members may also benefit from access to a group of mentors at OMSI that could support them in their own learning process.

Recording for Research Purposes

Many of the girls reported that the research-related video and audio recording negatively affected their engagement in DOW. While it is clear that researchers carefully followed IRB protocols, the girls who participated in the focus groups did not understand that their participation was voluntary and that they could stop at any time. In Year 4, it is recommended that OMSI staff explore processes that ensure girls understand the voluntary nature of research participation and obtain girls' assent each time they are recorded. It may also help to clarify with CBO staff that the research is entirely voluntary and that they are invited to speak on girls' behalf if the girls do not feel comfortable voicing their concerns to OMSI staff. Researchers might also consider alternate data collection strategies that may reduce girls' feelings of being singled out or might consider recording a limited number of program sessions rather than all sessions.

Evaluation Methods

Quantitative methods were employed in Year 3 to measure girls' knowledge and attitudes about engineering. It seems unlikely, however, that statistically significant changes could be observed on the attitude constructs over the short duration of the program. In addition, many knowledge and attitude measures did not perform as expected due to a strong ceiling effect. The strongest insight into girls' knowledge and attitudes was gained through the open-ended survey responses and the focus group data. In Year 4, the use of more in-depth individual or group interviews before (and after) girls' experience with DOW may better illuminate what changes—if any—take place in girls' understanding and attitudes over the course of the program.

The Year 4 evaluation would also benefit from strengthened data collection about program activities by OMSI staff. Recording attendance at staff and caregiver sessions, along with basic demographics about caregivers, for example, will enable evaluators to better understand who is being served through DOW.

DOW Educational Model

As noted above, this evaluation has identified several changes that can be made to strengthen the DOW program design. These include focusing more tightly on select constructs that the program has the greatest possibility of impacting, clearly defining those constructs, and bringing more rigor to the design of program activities that address those constructs. In addition, the model for reaching caregivers requires modification to more effectively reach and engage caregivers whose girls participate in DOW. Changes to the PD model would also be needed to achieve target outcomes for both OMSI and CBO staff.

The evaluation also sought to examine how the DOW model played out in the different CBOs. The key insight is that implementation of DOW needs to be tailored more specifically to the culture, assets, and needs of the partner CBOs. Rather than seeking to replicate DOW across different community sites, it will be more productive to identify points of synergy between OMSI and the CBO to leverage the assets of both organizations. The nature of a CBOs program design and the priorities and structures they set for working with their communities will be important to consider in determining how to best integrate DOW at the partner site. In addition, different levels of relationship building are required for CBOs that have worked with OMSI extensively in the past and those for whom DOW would introduce a new partnership relationship.

It is important to note that OMSI's differing relationships with the two CBOs in Year 3 strongly influenced the Phase 1 summative evaluation in Year 3. The strength of the relationship between OMSI and Adelante Mujeres supported the evaluators' ability to conduct focus groups with both girls and caregivers. At Girls, Inc., however, the evaluators did not have access to any program participants and were unable to conduct focus groups. As a result, the Phase 1 summative evaluation under-represented the perspectives of the Girls, Inc. girls and caregivers. This is an important limitation of the evaluation because the two CBOs served very different populations. Findings from the focus groups with Adelante Mujeres girls and caregivers, therefore, cannot be generalized to the Girls, Inc. participants.

This limitation with the Year 3 evaluation reflects the larger challenge and opportunity of working across different contexts and partnering with different CBOs. For example, the findings that caregivers are highly motivated to support their daughters' educations and that they want written materials aligning with the girls' curriculum are specific to the caregivers served by Adelante

Mujeres. Caregivers affiliated with other CBOs are likely to have different motivations and needs. In order to partner effectively with CBOs, it's important to learn about each organization and community and then adapt the program model in response to those particular cultures, needs, and assets.

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Appendices



Appendices

Appendix A: DOW lesson plans

DOW Adelante Mujeres Session 1 Draft Program Record
(a working document while development is in process)

Intro to Engineering

Learning Goals

- Set expectations for the entire cohort plan including commitments and goals.
- Set the stage for team building- start to get to know each other, and understand what the cohort is about.
- Introduce the engineering design process and understand that engineering is a process of approaching problems.

Program description

At a glance:

Program Type: Community-Based
Grade Level: 9-14 years young

Length of Program: 85 mins
of Participants: 22

Adelante Mujeres Agenda:

Time	Description	Minutes
3:15-3:25	AM Intro	10
3:25-3:40	Surveys	15
3:40-3:50	Ice Breaker (name/chairs/things in common)	10
3:50-4:10	Engineering Discussion	20
4:10-4:30	Create Design Notebooks (author's bio)	20
4:30-4:40	Closing Circle (GI Lead)	10

Supplies:

Engineering Discussion:

- 1 set of Engineer Cards per group
- 1 large master set

Design Notebook (per person):

- 1 binder
- Few markers
- Stickers?
- Author Bio Paper for inside cover
- Gluesticks and glitter?

- Pens

Other Supplies:

- Nametags
- Markers
- Extra consent forms?
- Chartpack
- Camera

Learner Experience

Step-by-step, what the student does:

1. *Opening circle (30 min)*
 - (i) Girls Inc will lead. Will include introducing names and learning about each other, as well as setting class expectations.
 - (ii) Will also pass out surveys during this time.
2. Cecilia's Surveys and This or That Activity (15 min)
 - (i) Veronika will lead
3. *Intro/Ice Breaker (10 min)*
 - i. Introduce ice breaker/ team building activities and their purpose and connection to the cohort's activities. Activity: *Human Sculpture* (Facilitator says a word of a machine "copy machine" for example, and the kids work out how to create that image and process using their bodies. May include sending adult out of the room so they can come in afterwards and try to guess what machine the kids created.)
4. *Engineering Discussion (10 min)*
 - Discuss preconceived ideas of what an engineer is. Create list of what we think of when we think of an engineer.
 - Pass out character cards and have students sort into who they think is an engineer, and who isn't.
 - Discuss why they put into those groups, then identify that they are all engineers. Give information about what each person does.
 - Discuss if our original list of engineer qualities was correct- what do we see that confirms it, and what do we see that doesn't fit our idea of an engineer?
 - Conclude: Engineers are a wide range of ages, genders, and ages, and the type of work they do varies a great deal.

Brainstorm qualities of an engineer—we'll need to be engineers when we're together, so we need to be these things (mostly emphasize persistence; engineers don't create something on the first try—they fail and fail and fail, but keep trying.) Qualities may include: creative, persistent, knowledgeable, works hard, good observer, social.

5. *Create Design Notebook (15 min)*

Pass out notebooks with pages and explain

- This notebook will help you record your journey through the program—the things you liked and didn't like and the designs you tried and improved on.
- It will also help us figure out how to make this program better.
- We'll use a different color section each class.
- After each activity they will answer questions about the class to help us improve it for future classes, and for other students.
- At the end of each class, we'll take the notebooks, but at the end of all the classes, they can keep them.
 - Decorate the cover to make it their own.
 - Write a 1-3 sentence autobiography that we will paste inside the cover along with their picture.
 - May share autobiography if there's time.

6. *Closing Circle (10min) Led by Girls Inc*

DOW Adelante Mujeres Session 2 Draft Program Record
(A working document while development is in process)

Engineering Process

Learning Goals

- Continue team building and getting to know each other.
- Introduce the engineering design process, understand that engineering is a process of approaching problems.

Program description

At a glance:

Program Type: Community-Based
Grade Level: 9-14 years young
Length of Program: 85 mins
Number of Participants: 22

Adelante Mujeres Agenda:

Time	Description	Minutes
3:15-3:25	AM Intro	10
3:25-3:35	Ice breaker (Machines)	10
3:35-3:45	Design Notebook Author Bio	10
3:45-3:55	Engineering Process Discussion	10 or less
3:55-4:20	Strawbees Design Activity	25
4:20-4:30	Closing Circle (AM Lead)	10

Supplies:

Strawbees (per group):

- 20-40 straws
- Handful of connectors
- Design cards

Design Notebook (per person):

- 1 binder
- Markers/pens

Other supplies:

- Nametags
- Markers

Learner Experience

Step-by-step, what the student does:

1. *Opening circle (10 min)*
 - AM will lead
2. *Intro/Ice Breaker (10 min)*
 - Group Machines (car wash, washer, lawn mower, etc.)
3. *Design Notebook Author Bio (10 min)*
 - Choose three adjectives (from the list or not)
 - Fill in their “Engineering Biography”
4. *Engineering Discussion (10 min)*
 - Remind students of the engineers we saw last session; what do you remember about them/last session?
 - Engineers build things to make life easier and better for people. They **solve problems** to help other people.
 - Ask about a time they created/built something, or something they have seen improve over the years they’ve been alive (television, computer, cell phone, etc.).
 - *Activity goals:*
 1. Thinking about someone else and doing something for them
 2. **Constantly improving** on their design
5. *Strawbees Activity (25 min)*
 - Each group (4-5 girls) will get an adult and a character and design something for them (they get two object cards; they decide what to make).
 - Pass out building materials, and show how to put them together (end of straw and middle of the circle).
 - First deal a Research card, then a Design card.
 - After creating at least one version, pass out an Improve card.
 - Debrief at the end. Let each team talk about their design, and how they improved their design after the Improve card.
6. *Closing Circle (10min)*
 - *AM leads*

DOW Adelante Mujeres Session 3 Draft Program Record
(A working document while development is in process)

Slow It Down

Learning Goals

- Continue team building and getting to know each other
- Focus on what to do when you're frustrated/after failure

Program description

At a glance:

Program Type: Community-Based
Grade Level: 9-14 years young

Length of Program: 85 mins
Number of Participants: 22

Adelante Mujeres Agenda:

Time	Description	Minutes
3:15 – 3:25	AM Intro	10
3:25 – 3:35	Ice breaker	7
3:35 – 3:45	Interview w/ Engineer	10
3:45 – 3:50	What to do when you're stuck	5
3:50 – 4:15	"Slow It Down" Activity	25
4:15 – 4:25	Design Notebook	10
4:25 – 4:30	Closing Circle (GI Lead)	5

Supplies:

Slow it Down Activity

- Outreach Kit

Strategies Discussion

- Chart pack
- Easel

Design Notebook (per person):

- 1 binder
- Markers/pens

Other Supplies:

- Nametags
- Camera

Learner Experience

Step-by-step, what the student does:

- 1) Opening circle (10 min)
 - AM will lead. Song & Highs/Lows
- 2) Intro/Ice Breaker (7 min)
 - “Splat” Name Game
- 3) Interview with an Engineer (10 min)
 - Emphasize that she loves engineering, and that she loves to help people/animals
 - Let the girls ask questions at the end
- 4) Strategies to use when you’re stuck (5 min)
 - Talk about engineering process (Ask, Imagine, Create, Test, Improve).
 - “Failure” isn’t a mistake; it’s a crucial part of the process! We will be “failing” every week to practice the process.
 - Brainstorm strategies together to use when they get stuck on a problem, such as:
 - Ask a friend for help
 - Draw it out, start over
 - Get together a group to brainstorm
 - Look at other people’s successful ideas
 - Read/learn more about it
 - Write strategies on chart pack and bring back to every class.
- 5) Emphasize importance of **“Test early, Test often!”** Students should test path as soon as possible and as often as possible to get information about what could be done better.
- 6) Slow it Down Activity (25 min)
 - Emphasize how engineers help people.
 - Ask if they’ve been hiking and if they’ve ever hiked up a big hill. What did the path look like? Would someone in a wheelchair be able to go on that path?
 - Brainstorm some important factors to think about if we’re designing something for someone in a wheelchair (smooth, not muddy, no sharp turns, not steep).
 - Pass out building materials, and show how to put them together.
 - Constraints include: ball must roll down from the top without touching it after releasing it. The slower it takes to reach the bottom, the better.
 - Students will create various designs and time each run.
 - Remind students of the “Improve” cards from session 2. How could they make their design even better for the people they’re designing it for?
 - If time allows, have girls present designs to class
- 7) Design Notebook (10 min)

- Write “Slow it Down” on the activity title page and answer survey questions.
- Remember that your answers help us improve future classes, so be honest!
- If there’s time, finish the Author Bio if you didn’t last week.

8) Closing Circle (5min)

- Led by Adelante Mujeres

DOW Adelante Mujeres Session 4 Draft Program Record
 (A working document while development is in process)

Bioswales *(Jardinería con sistema de biofiltración)*

Learning Goals

- Continue team building and getting to know each other
- Focus on what to do when you're frustrated/after failure

Program description

At a glance:

Program Type: Community-Based
 Grade Level: 9-14 years young

Length of Program: 85 mins
 Number of Participants: 24

Adelante Mujeres Agenda:

Time	Description	Minutes
3:10 – 3:20	AM Intro	10
3:20 – 3:25	Icebreaker song	5
3:25 – 3:40	Interview w/ Engineering Student	15
3:40 – 4:15	Bioswale Activity	35
4:15 – 4:25	Design Notebook	10
4:25 – 4:30	Closing Circle	5

Supplies:

Bioswales Activity

- Trays
- Sponges (green)
- Foam pieces (blue)
- Watering can
- Paper (preferably with squares)
- Colored pens/markers (include blue, green, and black)

Other Supplies:

- Nametags
- Camera

Strategies Reminder

- Chart pack
- Easel

Design Notebook (per person):

- Binder
- Markers/pens

Learner Experience

Step-by-step, what the student does:

- 9) Opening circle (10 min)
 - AM will lead
- 10) Ice Breaker (5 min)
 - Introduce new OMSI people
 - Veronika's song
- 11) Interview with an Engineering Student (15 min)
 - Emphasize that she loves engineering and helping people
 - Let the girls ask questions at the end
- 12) Bioswales Activity (35 min)
 - Talk about the rain in Portland (and the world) and where they think the water goes. Is the water that gets to the rivers clean rain water, or does it carry all the contamination it gathers along the way?
 - Explain (or let engineering student explain) what bioswales are, and how they help filter the rain water in order to prevent a "poo-nami" (an overflow of sewer water).
 - Emphasize how engineers help people and the environment.
 - Review the strategies for "What To Do When You Get Stuck"
 - Show them what materials they will be using, but hand out colored markers and graph paper for them to design their city plan.
 - After a few minutes, hand out the building materials and let the groups build their first idea.
 - When the groups have finished building their first idea on the tray, have each group bring their tray to the testing stations, while the rest of the groups watch.
 - Each group goes back and can adjust their city plan accordingly.
 - Have a second round of building and testing.
- 13) Design Notebook (10 min)
 - Write "Bioswales" on the activity title page and answer survey questions.
 - Remember that your answers help us improve future classes, so be honest!
 - If there's time, finish the Author Bio if you weren't able to last time.
- 14) Closing Circle (5min)
 - Led by Adelante Mujeres

DOW Adelante Mujeres Session 5 Draft Program Record
(A working document while development is in process)

Surgery

Learning Goals

- Continue team building and getting to know each other
- Focus on growth mindset and characteristics of engineers
- Continue repeating strategies for when you're stuck/frustrated

Program description

At a glance:

Program Type: Community-Based
Grade Level: 9-14 years young

Length of Program: 70 mins
of Participants: 24

Adelante Mujeres Agenda:

Time	Description	Minutes
3:20 – 3:30	Intro + Song	10
3:30 – 3:45	Design Notebooks (Role Models)	15
3:45 – 3:55	Biomedical Engineers Discussion	10 - 15
3:55 – 4:25	Surgery Activity	25 - 30
4:25 – 4:30	Closing Circle (AM Lead)	5

Supplies:

Surgery Activity

- People/animal cutouts
- Building supplies
- Obstacle supplies
- Laminated organs
- Example tools

Biomedical Engineers Discussion:

- Easel
- Chart pack

Other Supplies:

- Nametags
- Camera

Learner Experience

Step-by-step, what the student does:

7. *Intro + Song (10 min)*
 - (i) Veronika's song

 8. *Design Notebooks (15 min)*
 - (i) Focus on role models

 9. *Biomedical Engineers Discussion (10-15 min)*
 - Talk about how the activity today is called "Surgery," but the students will not be the surgeons. They will be the engineers who design the tools for the surgeons, also known as "biomedical engineers".
 - Veronika will talk a little about her dad's work as a biomedical engineer.
 - Show pictures of medical advancements that have been possible because of the work of biomedical engineers.

 10. *Surgery Activity (25-30 min)*
 - Emphasize how engineers help people.
 - Surgeons need special tools for the work they do, and engineers work to make tools for surgeons.
 - Students will create tools to remove the "ailments" from the human/dog body.
 - Once they think they have a helpful tool, they will give it to an adult ("the surgeon") to try it, and the adult will give feedback.

 11. *Closing Circle (5 min)*
-

DOW Adelante Mujeres Session 6 Draft Program Record
(A working document while development is in process)

Ziplines

Learning Goals

- Continue team building and getting to know each other
- Focus on diversity of engineering careers and characteristics of engineers
- Continue repeating strategies for when you're stuck/frustrated

Program description

At a glance:

Program Type: Community-Based
Grade Level: 9-14 years young

Length of Program: 75 mins
Number of Participants: 24

Adelante Mujeres Agenda:

Time	Description	Minutes
3:15 – 3:25	AM Intro + Song	10
3:25 – 3:30	Recap: Who Have We Met?	5
3:30 – 3:40	Discussion: Ziplines (who makes them and why)	10
3:40 – 4:10	Ziplines Activity	30
4:10 – 4:20	Fixed vs. Growing Mindset	10
4:20 – 4:30	Closing Remarks	10

Supplies:

Zipline Activity

- Lego people
- Cardboard
- Kit with string/buttons/clips/bottles
- Foam
- Straws
- Scissors
- Paperclips
- Binder clips
- Marbles
- Cotton balls
- Twist ties/Velcro
- Fan with ext. cord
- Spray bottle

- Images of zipline rescues
- Fixed vs. Growth handout
- Chartpack + easel

Other Supplies:

- Nametags
- Camera

Discussions:

Learner Experience

Step-by-step, what the student does:

1. *AM Intro (10 min)*
 - (i) AM Intro
 - (ii) Song, if time permits
2. *Class Recap (5 min)*
 - (iii) Who have we met?
 - (iv) Remind the class of different engineers who have visited
 - Discuss diversity of engineers
3. *Ziplines Discussion (10 min)*
 - What is a zipline? *A cable that starts at a higher point and ends at a lower point*
 - Who makes them? *Engineers! Civil, Mechanical, etc.*
 - What are ziplines used for? *Rescue missions, entertainment, delivery of goods, transportation, etc.*
 - Show images of ziplines being used to rescue people.
4. *Ziplines Activity (30 min)*
 - Emphasize how engineers help people.
 - Ask what would happen if someone is injured while hiking, or if a natural disaster wiped away the only path to get down the mountain. How could you get the person (or people) down the mountain safe and quickly?
 - Carrier must clip on and off the line easily, fit at least one (Lego) person, and it cannot get stuck on the way down.
 - Students will create various designs and try them out, considering how to make the trip most safe and comfortable for the person riding.
 - Halfway through the activity, add challenges (such as more people or animals to carry, or a storm with wind and/or water (use fan and spray bottle)).
 - If time allows, have girls present designs to class.
5. *Fixed vs. Growth Mindset*
 - Discuss whether people are born smart, or develop their abilities through persistence and effort.
 - Pass out handouts to girls
6. *Closing Remarks (10 min)*

DOW Adelante Mujeres Session 7 Draft Program Record
 (A working document while development is in process)

Assembly Line

(Línea o cadena de producción)

Learning Goals

- Wrap up our time together and recap important messages
- Continue repeating strategies for when you're stuck/frustrated

Program description

At a glance:

Program Type: Community-Based
 Grade Level: 9-14 years young

Length of Program: 120 mins
 Number of Participants: 24-26

Chicas Agenda:

Time	Description	Minutes
3:20 – 3:25	Opening Circle	5
3:25 – 3:35	Recap	5-10
3:35 – 3:45	Intro to Assembly Lines and Industrial Engineers	10
3:45 – 4:15	Assembly Line Activity	30
4:15 – 4:45	Surveys	30
4:45 – 5:00	Small Group Reflection + Snacks	15
5:00 – 5:15	Class Debrief + Goodbyes	10-15

Supplies:

Assembly Line Activity

- Example Kit
- Beans
- Measuring cups
- Small Ziploc bags
- LED lights
- Wax paper
- Sandwich Ziploc bags
- Straws
- Strawbees
- String
- Cardboard pieces
- K'nex pieces
- Paper bags
- Bin to store kits in

Closing Discussion:

- FEN Flyer

Other Supplies:

- Nametags
- Camera

Learner Experience

Step-by-step, what the student does:

1. Opening circle (5 min)
 - Chicas Intro
 - Intro songcap (5-10 min)
 - Review what we have learned in previous sessions
 - What types of engineers have we learned about?
 - What activities have we done?
 - Emphasize key points: skills (creativity, persistence, collaboration, altruism, patience), and jobs in the field (biomedical engineer, industrial engineer, mechanical engineer, etc).

2. Intro to Assembly Lines and Industrial Engineers (10 min)
 - How are products made? Think of a bicycle and all of its parts. How is it assembled? Do you think each bicycle is assembled by just one person?
 - What if someone needs to produce one thousand bikes? Will they hire one thousand people to make one thousand bikes?
 - When we need to make a lot of the same products, **industrial engineers** help design systems to make the process faster and more efficient. These systems are called **assembly lines**. Some parts may be automated (operated by machines) and some parts may be operated by people.
 - Today you will be industrial engineers, and you will have to create the best and most efficient way to produce a large number of something.

3. Assembly Line Activity (30 min)
 - There was a large earthquake in Chile! There are one million people who had to leave their homes and need your help! We need to make one million survival kits, and we need to figure out the fastest, best way to do it.
 - Each survival kit should have: a bag of beans, a flashlight, a rope, a Swiss army multi-tool, and a crank powered radio (made of K'nex).
 - There are __ students in here, so we will time ourselves to see how long it takes to make __ kits. First, each one of us will make one kit, and then we will come together and see if we can engineer something better.
 - In order to get this activity to work, we will need to work in different groups each round, listen to each other's ideas, and sometimes do jobs that aren't our favorite.
 - The class will be split up in two for the sake of space, but you will all be working together towards the same goal. Once a kit is ready and has been checked, it should be deposited in the blue bin in the middle of the classroom.
 - Each table will hold a different station. To assemble a kit, you'll need to visit each station, make or assemble each item, put all your items in a

brown paper bag, and drop it off in the bin. We will start the timer when I say go, and stop the timer as soon as the last kit is in the bin.

- After announcing time, have every student disassemble their bags (or have the adults that aren't facilitating do it) to try it again. Before beginning, hold a brief discussion about how to improve the process so that the bags can be created even faster.
 - What was the fastest item to assemble? What was the slowest?
 - Was any part of the assembly line especially difficult or confusing? How could we make it smoother?
- Repeat this process as many times as desired (or as many times as the schedule permits), trying different sizes of groups, different order of tasks, and rearranging stations.

4. Surveys (30 min)

- During the last feedback session of the activity, adults that aren't facilitating will clean up the tables.
- Taline will distribute surveys.
- Veronika will facilitate This or That survey.

5. Small Group Reflection + Snacks (15 min)

- As soon as each girl finishes their last survey, they will head into the other room where there will be tables with snacks set up, and an adult facilitator at each table.
- Once a table is filled, the adult facilitator will conduct a small, informal reflection on the class with prompting questions.

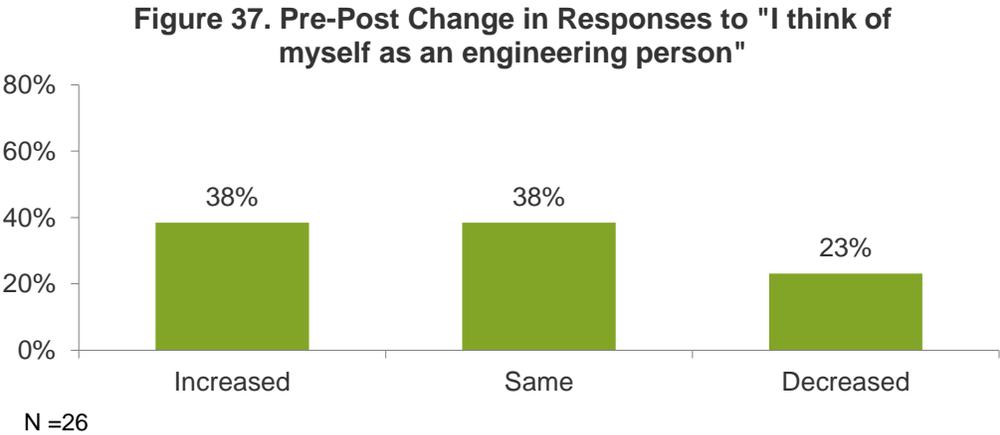
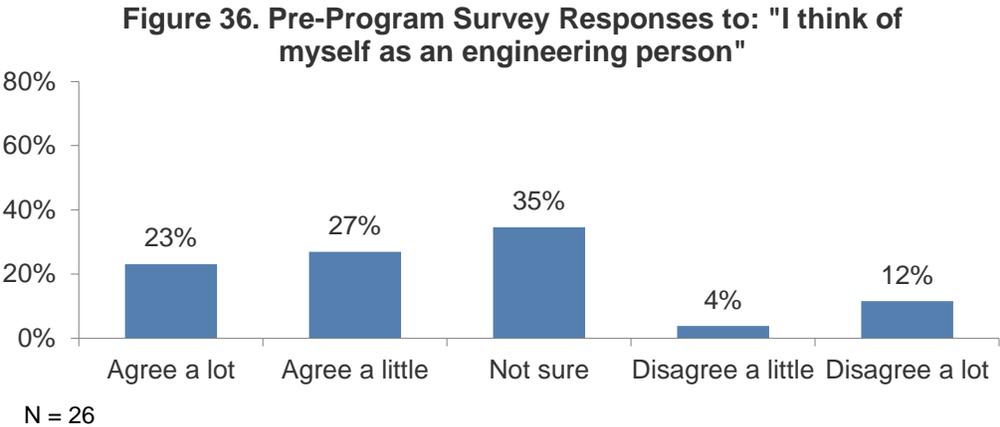
6. Class Debrief + Goodbyes (10-15 min)

- Thank girls for time together
- Review activities we've done
- Ask what their favorite activity was
- Ask what they learned with us
- Ask where they can use skills in the future
- Hand out small thank you gifts from OMSI

Appendix B: Data about engineering and science identity

Engineering and science identity

In support of the DOW research activities, the evaluation also sought to gather exploratory information about engineering and science identity through several pre-program and post-program survey items. No significant differences were observed when comparing matched pre- and post- responses. In the pre-program survey, 50% of respondents agreed that they thought of themselves as an engineering person. Approximately the same number (48%) agreed that others thought of them as engineering people (See Figures 35-38).



Wilcoxon Signed Rank Test (2-tailed), Z=-.823, p=.410
 Statistically significant when p<.05

Figure 38. Pre-Program Survey Responses to: "Other people think of me as an engineering person"

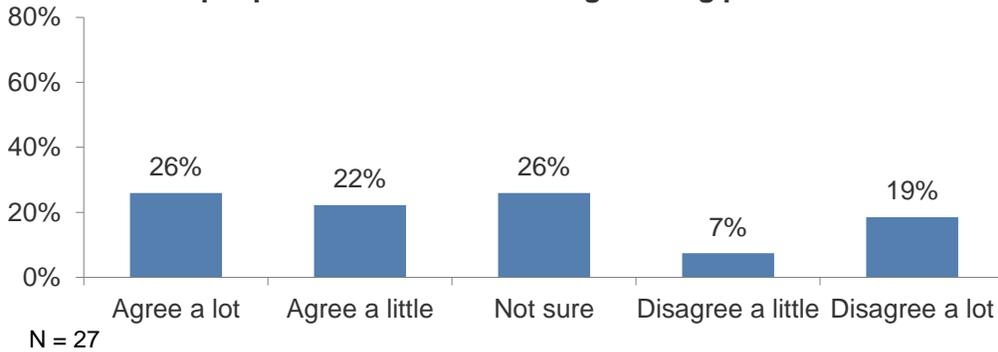
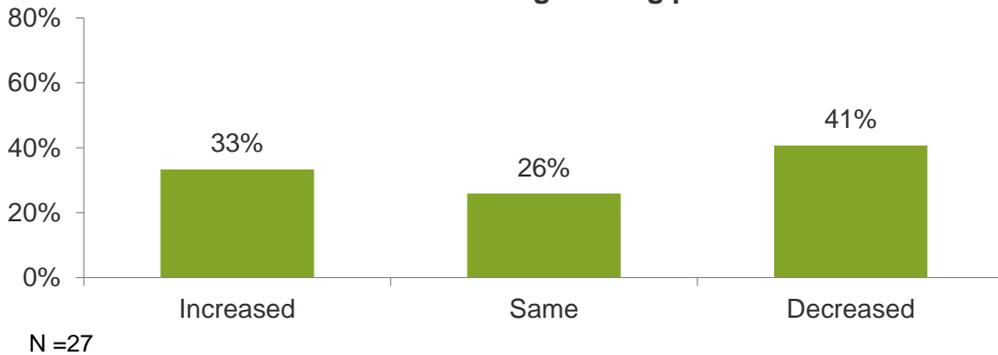


Figure 39. Pre-Post Change in Responses to "Other people think of me as an engineering person"



Wilcoxon Signed Rank Test (2-tailed), $Z = -.211$, $p = .833$
 Statistically significant when $p < .05$

Respondents reported a stronger sense of science identity, with more than three-fourths (81%) agreeing in the pre-program survey that they thought of themselves as a science person. About two-thirds (69%) agreed that others thought of them as science people (See Figures 39–42).

Figure 40. Pre-Program Survey Responses to: "I think of myself as a science person"

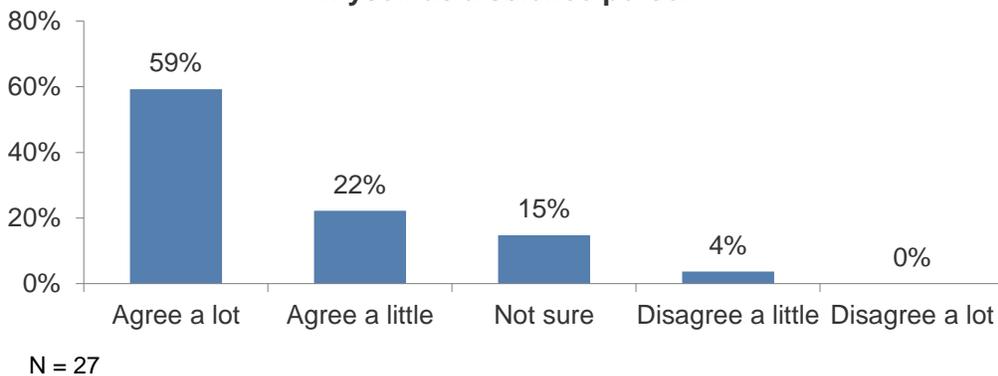
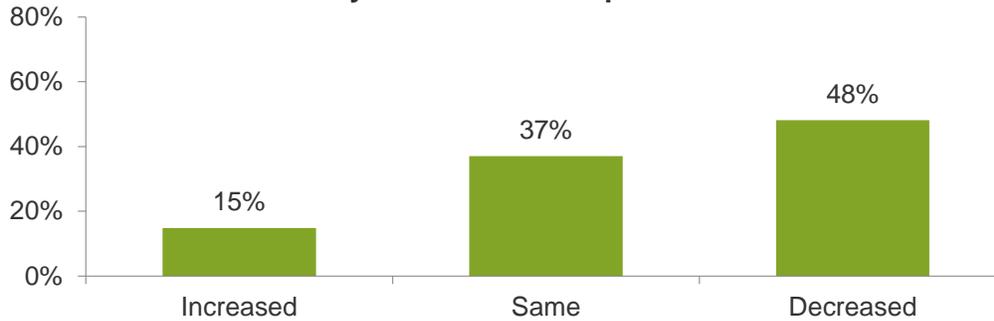


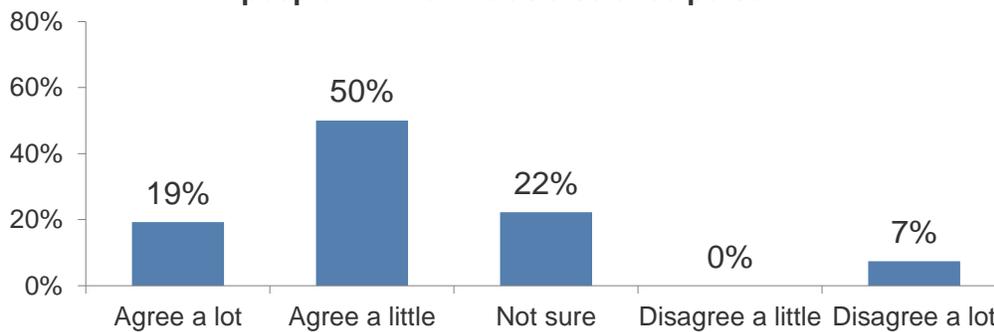
Figure 41. Pre-Post Change in Responses to "I think of myself as a science person"



N = 27

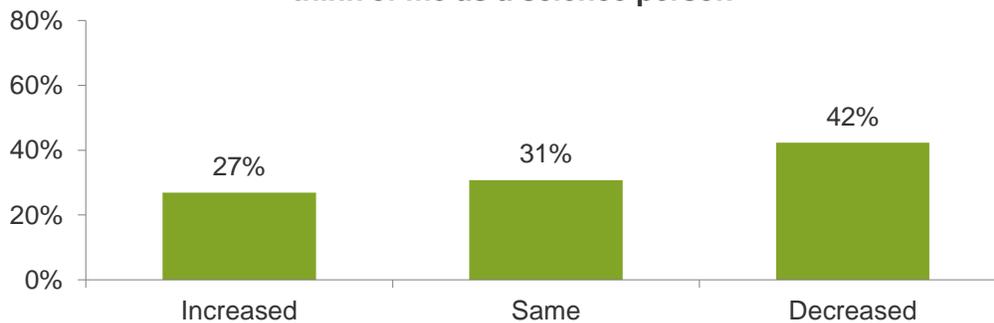
Wilcoxon Signed Rank Test (2-tailed), Z=-1.326, p=.185
 Statistically significant when p<.05

Figure 42. Pre-Program Survey Responses to: "Other people think of me as a science person"



N = 26

Figure 43. Pre-Post Change in Responses to "Other people think of me as a science person"



N = 26

Wilcoxon Signed Rank Test (2-tailed), Z=-.565, p=.572
 Statistically significant when p<.05

During the focus groups, evaluators also explored engineering identity. When asked if they had engineering qualities, five of the fourteen participants said that they did. One participant shared that she was surprised she had the qualities of an engineer, which she described as “building stuff and problem solving.” She noted that she did not have math skills. Another participant said that she had been surprised to discover that she could build things. All of the participants seemed to understand that there are women engineers and that they themselves could grow to become engineers. They appeared confident that engineering careers were open to girls, even if fewer women are currently in the field than men.