

**Designing Our World  
Grant Year 4 Phase II  
Summative  
Evaluation Report**

**Prepared for  
Oregon Museum of  
Science and Industry  
Fall 2017**



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## Executive Summary

Designing Our World (DOW) was a four-year National Science Foundation (NSF)-funded initiative in which the Oregon Museum of Science and Industry (OMSI) sought to promote girls' pursuit of engineering careers through community-based programming, exhibition development, and identity research. The overarching aim of DOW was to engage girls ages 9–14 with experiences that illuminate the social, personally relevant, and altruistic nature of engineering. Target audiences included girls who participated in programming, professional audiences, parents/caregivers, and members of the public who visited OMSI. Year 4 programming was delivered in 2017 in partnership with Adelante Mujeres (AM), a community-based organization that serves low-income Latinas and their families in western Washington County, Oregon.

OMSI contracted with Garibay Group to conduct a summative evaluation of the DOW project. The key evaluation questions focused on girls participating in DOW, parents/caregivers of girls participating in DOW, AM staff who participated in professional development (PD) activities, members of the general public who visited the DOW exhibition, and the DOW Educational Model. 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. The study employed a mixed-methods design that combined quantitative and qualitative data.

The evaluation found that DOW had its strongest outcomes for girls' engagement in engineering activities. Attendance at DOW sessions was strong, and respondents reported relatively high levels of enjoyment. There is also evidence, albeit indirect, that girls demonstrated persistence during DOW activities, particularly given the time constraints of the program sessions. While engagement outcomes were positive, the girls showed only moderate interest in continuing to take part in engineering activities.

Small sample size limited our ability to draw conclusions about what learning occurred over the course of the program. The quantitative data, however, do suggest small increases in knowledge that engineers help and solve problems; in addition, returning girls entered with a greater knowledge than did new participants that engineers help people. Finally, data suggest that DOW had limited impact concerning the importance that girls place on engineering in general and, more specifically, on the value of engineering in their lives.

The number of parents/caregivers who engaged with DOW In Year 4 was limited; it was, however, an increase from the engagement in Year 3. Parents/caregivers who participated in workshops enjoyed them. Although the vast majority of workshop participants surveyed reported having learned something, the data indicate that DOW did not build strong awareness among parents/caregivers concerning engineering or gender equity in engineering. Few individuals in surveys and focus groups could describe specific things they learned.

Regarding PD, we found that DOW provided AM staff with clear examples of engineering activities for the girls they serve and demonstrated the process of delivering high-quality engineering activities in the after-school setting. AM staff reported becoming more comfortable and confident in offering engineering activities and has already taken steps to incorporate DOW activities into the Chicas after-school and summer camp programs. AM staff also reported gaining awareness of gender inequity in engineering and learning strategies for engaging girls in engineering. Although the evaluation found that AM staff gained specific knowledge about gender inequity in engineering, it is unclear what strategies to engage girls in engineering, if any, staff members gained beyond the ability to implement specific DOW activities.

The evaluation found strong evidence that visitors enjoyed the DOW exhibition and engaged with a range of exhibit elements. The data also indicate that respondents left the exhibit with increased understanding of the nature of engineering. We observed statistically significant increases in the levels of agreement among participants that engineering is a creative endeavor, that engineering contributes to many different aspects of daily life, and that engineers help people. These gains occurred even though respondents had reported high initial levels of agreement. Many respondents, however, were unclear that the exhibition focused on engineering. When asked how they would explain the exhibit to others, just 10% of respondents related it to engineering, although some respondents discussed engineering concepts without using the term. Overall, respondents expressed very positive feedback about the exhibition, noting that it was hands-on and interactive, child-focused, fun, and educational.

Finally, although it is not yet fully realized, the DOW Educational Model appears to hold some promise for building community around girls in order to support their engagement with engineering. The model demonstrated its greatest success in engaging the AM staff as partners in that community. The evaluation also revealed that selection of CBO partners was a key factor

in the success of projects like DOW; the CBO and its context are critical to a program, not just as settings in which to deliver programming. OMSI will be best served by choosing a CBO interested in expanding STEM offerings and providing staff with robust PD including specific skills and knowledge.

Although parents/caregivers in the AM community are highly engaged and supportive of their girls, they have not been drawn into the DOW community of stakeholders. This is an area that will require further consideration. On the other hand, the field trip to Nike and the involvement of the guest engineers provide examples of how community stakeholders have been successfully involved in supporting girls. Efforts to expand and deepen such involvement could further develop the community of stakeholders and provide more meaningful experiences for girls.

Among DOW's strengths are its focus on a conceptualization of engineering well-grounded in research on engaging girls (for example, Fadigan & Hammrich, 2004; Jenkins & Pell, 2006; NAE, 2008; Weisgram & Bigler, 2006) and the OMSI team's unwavering focus on bringing that vision of engineering into all aspects of the project. OMSI may wish to use a similar approach to conceptualizing the model, perhaps looking to the literature to identify how to build such a community and what key features are associated with its success.

# Overview: Project and Evaluation



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Designing Our World (DOW) was a four-year National Science Foundation (NSF)-funded initiative in which the Oregon Museum of Science and Industry (OMSI) sought to promote girls' pursuit of engineering careers through community-based programming, exhibition development, and identity research. DOW's overarching aim was to engage girls ages 9–14 with experiences that illuminate the social, personally relevant, and altruistic nature of engineering. Target audiences for the project included girls who participated in programming, professional audiences, parents/caregivers, and members of the public who visited OMSI. OMSI contracted with Garibay Group to conduct a summative evaluation of the DOW project.

The OMSI team aimed to be responsive to the organizations with which they partnered, the girls and parents they engaged in programming, and the larger context in which the organizations and families were positioned. OMSI staff also sought to incorporate their own ongoing learning into the project in order to refine and improve DOW offerings. While the overall goal for DOW remained constant, the project's implementation evolved over time. As the team refined its thinking and altered the implementation, the underlying model came more clearly into view. OMSI staff described the model this way in summer 2017:

*The vision for the DOW model is to empower and promote girls' pursuit of engineering careers by cultivating a community of stakeholders (including OMSI staff, CBO staff, engineering role models, and caregivers) to engage girls with experiences across different contexts (community, museum, home) that illuminate the social, personally relevant, and altruistic nature of engineering.*

As part of program development and anticipated program revisions and refinements, the DOW evaluation included front-end and formative evaluation phases in Years 1 and 2 with summative evaluation slated for Years 3 and 4. The DOW team, however, felt it important to continue evolving the program and implementation through Years 3 and 4.

The evaluation sought to respond to this shift while also focusing on assessing outcomes. This report presents findings from Year 4 of the initiative. Due to some shifts in program implementation between Years 3 and 4, we were unable to aggregate the data across those



years into an overall summative evaluation. Instead, this report corresponds to Year 4, or Phase 2, of the summative evaluation.

Year 4 programming was delivered in 2017 in partnership with Adelante Mujeres (AM), a community-based organization that serves low-income Latinas and their families in western Washington County, Oregon. DOW was implemented as part of AM's Chicas Youth Development after-school program at Echo Shaw Elementary School in Forest Grove, Oregon.

OMSI staff and AM staff partnered to engage girls in engineering activities that showcased the altruistic nature of engineering through challenges such as designing and building a communication device for use in a classroom during an earthquake, experimenting with different materials to prevent a building from collapsing during an earthquake, designing equipment to carry marine sensors underwater, and designing a gift for a friend. Female guest engineers served as role models in select sessions. As part of the Chicas program at AM, five DOW lessons and two field trips were implemented in English and Spanish over 10 weeks (January 26 through April 7). The program concluded with a Family Engineering Night (FEN) at OMSI on April 9 attended by DOW participants, their parents and caregivers, and other families involved with the Chicas program. (See Appendix A for descriptions of each activity.) Girls participating in DOW were 9–14 years old and Latina.

The OMSI team sought to build caregivers' and parents' awareness of engineering and provide opportunities to engage their girls around engineering. To do this, OMSI staff conducted workshops for caregivers at Echo Shaw during Year 4. OMSI held a caregiver orientation session on January 19, a workshop on gender equity in engineering on January 20, and a workshop on engaging girls in engineering on March 23. Workshops were conducted in Spanish and English in response to attendees' preferences. OMSI staff also partnered with AM staff to invite caregivers and parents to attend the April 9 FEN, providing free transportation and free admission to the science center. Finally, OMSI staff developed a take-home engineering activity for girls to share with their caregivers and parents at home. (See Appendix B for summaries of the content for the two workshops.)

The DOW project also involved professional development (PD) for AM staff. The specific model for PD was one of the DOW components that shifted over time as OMSI staff refined the project. OMSI staff envisioned PD as being embedded in the delivery of the DOW sessions for girls: that

is, one or two AM staff would be present in the room while OMSI staff delivered the sessions. The aim was for OMSI staff to model, for AM staff, how to engage girls in engineering activities. In Year 3, OMSI staff also conducted PD workshops for a larger group of AM staff and experimented with reflective discussions as a way to foster reflection and learning for those AM staff present during program sessions. In Year 4, the OSMI staff initially planned to offer development in three components: embedded PD, PD workshops, and reflective discussions.

As the year unfolded, the OMSI team revised this plan and decided *not* to offer PD workshops. Instead, OSMI staff incorporated the planned workshop content into the reflective discussions. As a result, three AM staff members, out of a total of nine employees, were involved in two Year 4 PD activities: observing the DOW sessions that OMSI implemented and participating in reflective discussions.

When we learned that the PD workshops would not take place, we revisited the desired PD outcomes and the indicators previously identified with the OMSI team. Because the initial evaluation plan was predicated on a larger number of staff participating in workshops, we imagined that these might need to be revised, since the outcomes and indicators aligned with the planned workshop content. After some discussion, the OMSI team indicated that the initial outcomes and indicators were still appropriate for the evaluation since the same content was being delivered, albeit in a different form. (See Appendix C for an overview of the reflective discussions.)

The DOW leadership team was also interested in learning about the DOW Educational Model developed and asked the Garibay Group team to identify insights about the Model that had emerged from the implementation in order to inform future work.

The final DOW component in this evaluation is the Designing Our World exhibition installed at OMSI on December 22, 2016. The exhibition includes hands-on, interactive elements designed to communicate a vision of engineering as a creative endeavor that contributes to various aspects of daily life. The exhibit, located in a busy, high-traffic area of OMSI, includes five types of components: water tables (4), shake tables (3), wind components (2), a bridge, and panels with text and images. (See Appendix D for photographs of the exhibition.) While the primary focus of the evaluation was the programming components of DOW, we did examine a number of desired outcomes related to the exhibition.

## **Evaluation Questions**

The key questions for the Phase 2 summative evaluation for the DOW program were:

### ***Girls participating in DOW***

- Are girls engaged in the program? Do they enjoy their experiences in DOW?
- Do girls gain awareness that engineers contribute to solving problems across the world?
- Do girls demonstrate persistence when engaging in DOW engineering activities?
- Do girls view engineering work as valuable?

### ***Parents/Caregivers with girls participating in DOW***

- Do parents/caregivers engage in DOW workshops? If so, do they enjoy the workshop activities?
- Do parents/caregivers engage in DOW engineering activities with their daughters? If so, do they enjoy the activities?
- Do parents/caregivers gain awareness that engineers contribute to solving problems across the world?
- Do parents/caregivers develop awareness of gender inequity in engineering fields?

### ***Adelante Mujeres Staff***

- Do participants gain awareness that engineers contribute to solving problems across the world?
- Do participants develop awareness of gender inequity in engineering fields?
- Do participants deepen their understanding of informal education strategies to engage girls in engineering?
- Are participants motivated to continue using DOW strategies and materials to engage girls in engineering?

### ***General Public***

- Do visitors to the DOW exhibition enjoy their experiences?
- Do visitors deepen their understanding that engineering is a creative endeavor?
- Do visitors deepen their awareness that engineering contributes to many different aspects of daily life?

### ***DOW Educational Model***

- Overall, how does the DOW Educational Model play out in the various CBO contexts?
- How do OMSI staff define and understand the DOW Educational Model?
- What insights have emerged in implementing the DOW Educational Model that can inform future programming partnerships with community-based organizations?

### **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 impact (Frierson, Hood, & Hughes, 2010). In spring 2017, a diverse team of bilingual/bicultural researchers collected data from girls and caregivers/parents participating in DOW in English and Spanish, as appropriate, based on participants' preferences. Garibay Group developed all data collection instruments simultaneously in English and Spanish to ensure construct equivalence. Data were collected in spring and summer 2017 from AM staff, guest engineers, and the general public in English.

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' focus groups:* In order to gain a deeper understanding of girls' experiences, evaluators conducted two focus groups with girls who had participated in DOW. The focus groups were held in April 2017, three weeks after completion of the DOW program. AM staff members contacted caregivers to invite their girls to participate, seeking a balance across grade levels and new and returning participants. Though separate focus groups were planned for new and returning girls, separate groups could not be held due to the small amount of girls available. Evaluators used interactive activities and techniques tailored to participants' age range. Both

focus groups were audio-recorded. Each girl received a \$10 gift card honorarium for her participation.

### ***Parents/Caregivers***

*Parent/caregiver workshop survey:* Parents and caregivers who attended workshops completed a survey at the end of each workshop. The surveys focused on parents' and caregivers' enjoyment of the workshop, their understanding of the topics presented, and their perception of the workshop's value.

*Parent/caregiver focus group:* Evaluators conducted two focus groups with parents/caregivers who had girls participating in DOW. Conversations focused on the value that parents and caregivers placed on the DOW program, activities and conversations that took place at home related to DOW, and their experiences with parent/caregiver workshops and FEN. The focus groups took place in April 2017, three weeks following completion of the DOW program. AM staff invited all parents of DOW girls to participate. Both focus groups were audio-recorded. Participants received a \$25 honorarium for their participation.

### ***Adelante Mujeres Staff***

*Staff pre-interview questionnaire:* Evaluators administered an online questionnaire to AM staff members involved with the DOW project in order to inform the subsequent group interview with these individuals. The questionnaire focused on staff members' perception of their own learning over the course of the project, exploring their awareness of the field of engineering and gender inequity in engineering and gathering data about their motivation and comfort in offering girls engineering-related activities. The questionnaire was administered in May and June 2017.

*Staff Interviews:* Evaluators conducted a group phone interview with AM staff members to reflect on their experiences with DOW, their observations about its impact on girls and parents/caregivers, and the influence of the program on their own learning. The interview took place in July 2017 and was audio-recorded.

### **Guest Engineers**

*Guest engineers survey:* Evaluators administered a brief online survey to gather feedback from the guest engineers in regard to the DOW Educational Model. The survey focused on engineers' expectations for their participation, their observations of girls' response to DOW, and their sense of connection to a community of DOW stakeholders. The survey was administered in June 2017.

### **General Public**

*Exhibit exit surveys:* Exit surveys were used to gather feedback from visitors on a number of items including their enjoyment of the exhibition, the extent to which the exhibition helped them develop awareness of engineering, and their suggestions for improving the exhibition. The survey included both open- and close-ended survey items. Trained data collectors intercepted visitors as they left the exhibition and asked them to complete a verbally-administered survey. As the data were collected, we continually reviewed them to check data quality and identify emerging patterns. Based on this real-time analysis, we added one item to the survey at the midpoint of data collection and used the revised instrument for the second half of data collection. Surveys were collected in May 2017.

### **Sampling Frame**

Surveys for girls and their parent/caregivers were administered to everyone present at the session. For focus group data, we used a convenience sample. Although Adelante staff invited all caregivers to participate, caregivers self-selected both for their own participation in focus groups and for the participation of their girls. To conduct the staff survey and interview and the guest engineer survey, we used purposive sampling and invited those directly involved with the program to participate. Staff and guest engineers self-selected to participate, since doing so was voluntary. Finally, in conducting exhibition exit surveys, we used random sampling.

### **Data Analysis**

Quantitative data were analyzed using basic descriptive statistics and summarized in bar charts and tables. Survey data from the girls were analyzed in two ways. First, responses were matched to obtain individual baseline and post-program response comparisons and statistical testing was conducted to identify significant differences between pre- and post-program data. Survey responses were then analyzed at the group level to identify overall trends in the data. At

times, observed differences between groups suggested a pattern in the data but were not statistically significant. These data are discussed in this report because it is unclear whether no significant difference existed between the groups or whether a difference *did* exist but with a sample size too small to allow detection. We present survey data 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 between languages. Data were then analyzed using inductive coding (Strauss & Corbin, 1990; Patton, 2015), enabling 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, Huberman, & Saldaña, 2014). Quotations are reported in the original language in which data were collected, with English translations provided for Spanish quotations. Grammar and spelling are not corrected in quotations in order to preserve the respondent's voice; grammar and spelling are correct in the English translations to ensure clarity, however.

## **Limitations**

As in any study, this evaluation had certain limitations. For instance, surveys were administered to all girls present during the appropriate session. Although the aim was 100% participation, we were unable 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.

Focus groups with girls and caregivers and drew on a convenience sample. Although all caregivers with girls participating in DOW were invited, respondents for focus groups did self-select. Similarly, although the sampling of AM staff members was purposive, not all who participated in DOW completed the questionnaire or participated in the group interview. In addition, not all engineers serving as guest engineers during DOW completed the role model survey.

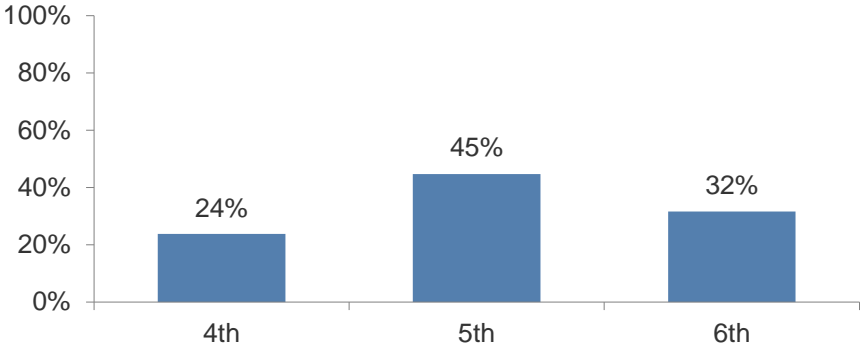
As a secondary component of the evaluation, data collection regarding the DOW exhibition was limited in scope. Employing an exit survey yielded a large sample size that supported statistical analysis; these data, however, do not provide the depth or nuance that observations or interviews would yield.

**Participants and Respondents**

***Girls***

Thirty-eight girls participated in DOW in Year 4. Girls ranged from fourth to sixth grade, with about half (45%) in fifth grade (See Figure 1). All girls were Latina.

**Figure 1. Grade Level of Participants**

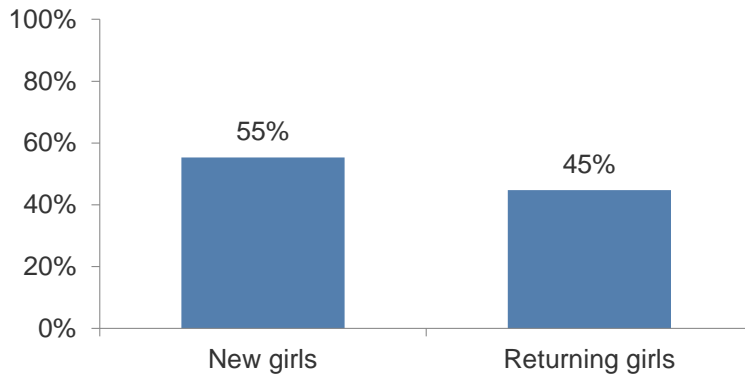


N = 38

DOW engaged two groups of girls in engineering activities this year: those new to the DOW sessions and those returning for a second year. Since the Year 3 FEN was open to all Chicas participants, it is possible that girls new to the DOW sessions may have had some prior exposure to DOW through attendance at the FEN. Participation was relatively evenly divided between the two groups, with slightly more new girls (55%) than returning girls (45%) (see Figure 2).



**Figure 2. Prior Involvement of Participants**



N = 38

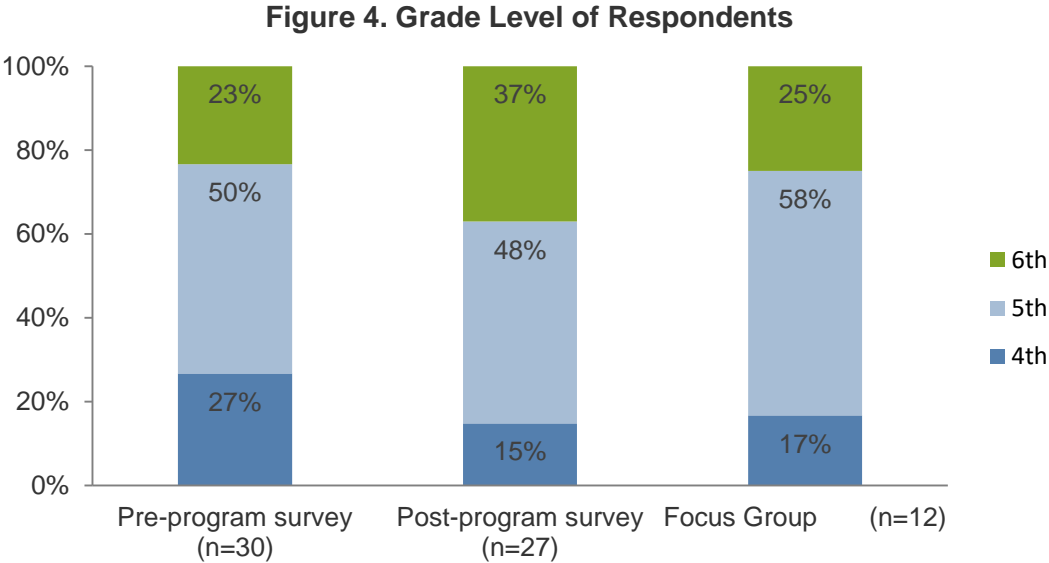
Most new girls were in fourth grade (43%) or sixth grade (38%), while most returning girls were in fifth grade (77%) (see Figure 3).

**Figure 3. Grade Level by Prior Involvement**



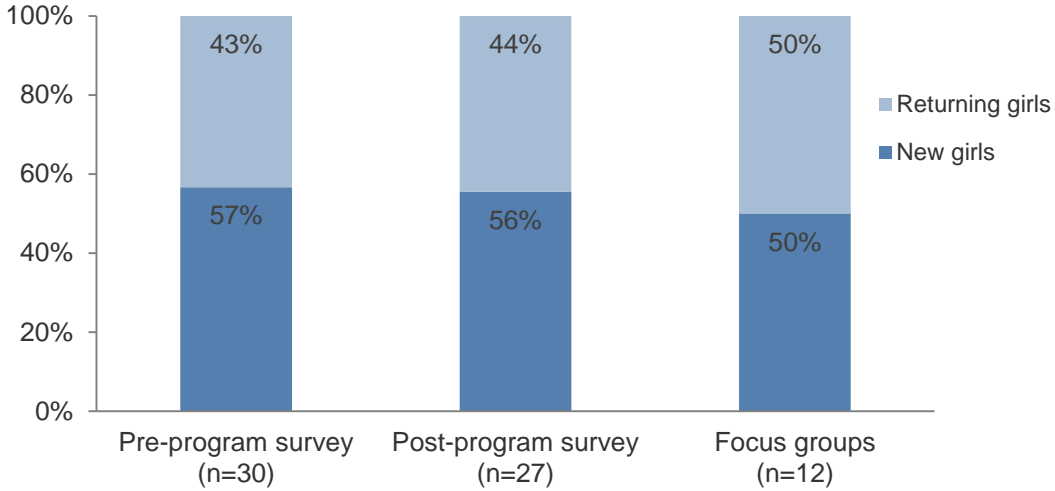
Data were collected from 36 girls, which represented 95% of the population that participated in DOW in Year 4. Seventy-nine percent of participants completed the pre-program survey and 71% completed the post-program survey. Sixty percent of participants completed both pre- and post-program surveys. The number of respondents for individual surveys and items ranged from 25 to 30. Thirty-two percent of participants participated in a focus group.

Nearly half of the respondents were in fifth grade (50% for pre-program survey, 48% for post-program survey, 58% of focus group participants), which roughly mirrored the proportion of program participants in fifth grade (45%) (See Figure 4).



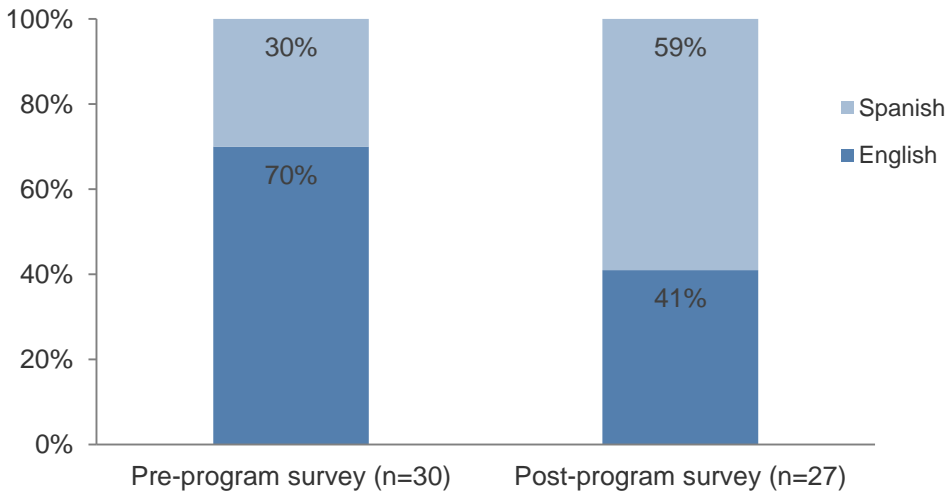
The proportion of new and returning girls among respondents also mirrored the overall proportions among program participants, with slightly more new girls responding than returning girls (57% new girls for pre-program survey, 56% for post-program survey, and 50% for focus groups) (See Figure 5).

**Figure 5. Prior Involvement of Respondents**



In the pre-program survey, nearly three-fourths of respondents (70%) chose to provide data in English, compared with fewer than half (41%) in the post-program survey (See Figure 6). Focus groups were conducted in a blend of English and Spanish, with the majority of the conversation taking place in English.

**Figure 6. Survey Version Completed**



**Parents/Caregivers**

Nine parents/caregivers attended the January 20 workshop and 11 attended the March 23 workshop. One hundred percent of attendees completed the post-workshop surveys, all completing the survey in Spanish. Twelve parents/caregivers participated in focus groups, which were conducted entirely in Spanish.

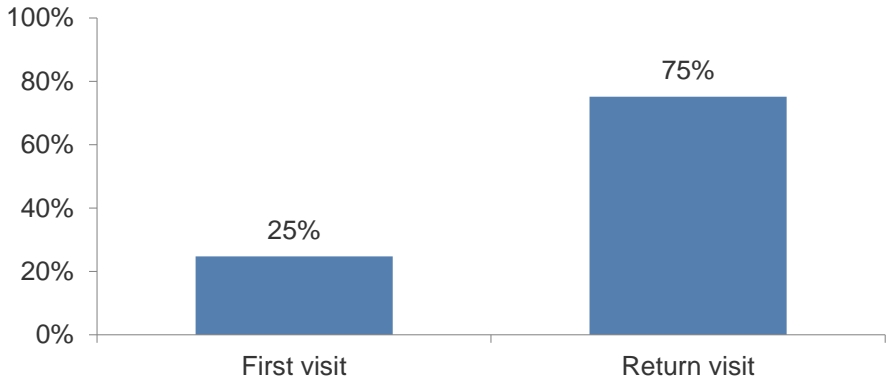
**Adelante Mujeres Staff**

Three staff members from AM provided responses to the staff survey, including the Chicas program manager, Chicas program facilitator, and AM grants coordinator. Two of these staff members participated in the group interview.

**General Public**

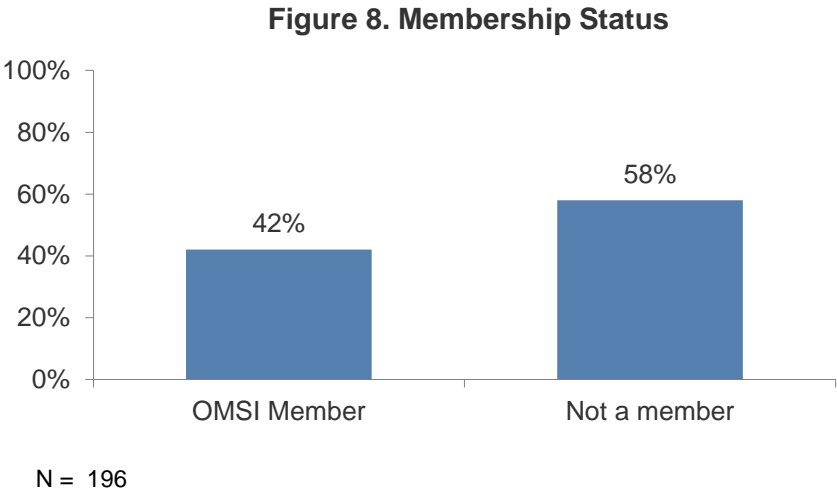
Data collectors invited 739 OMSI guests who had visited the DOW exhibition to respond to the exhibition exit survey. We collected 227 completed surveys, a response rate of 31%. Responses for individual items ranged from 95 to 227 respondents. A quarter of respondents (25%) reported that they were visiting OMSI for the first time (See Figure 7).

**Figure 7. Prior Visits to OMSI**

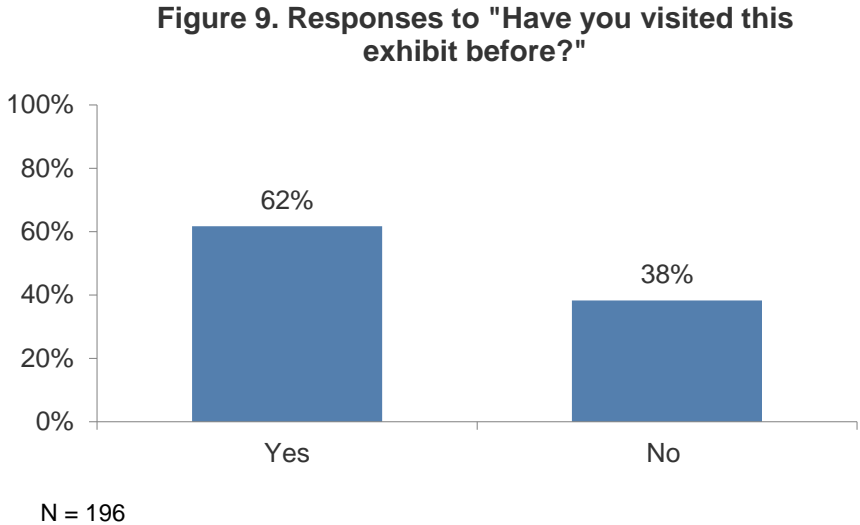


N = 226

More than a third of respondents (42%) were OMSI members (See Figure 8).

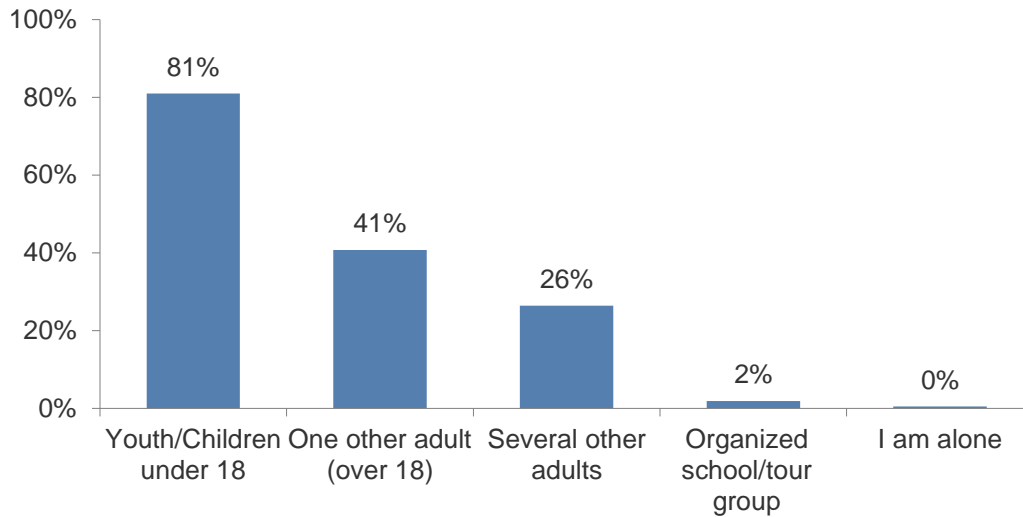


Nearly two-thirds of respondents (62%) had visited the DOW exhibit previously (See Figure 9).



More than three-quarters of respondents (81%) reported they were visiting OMSI with youth or children under age 18 (See Figure 10). More than two-thirds of respondents (67%) were visiting with one or more other adults.

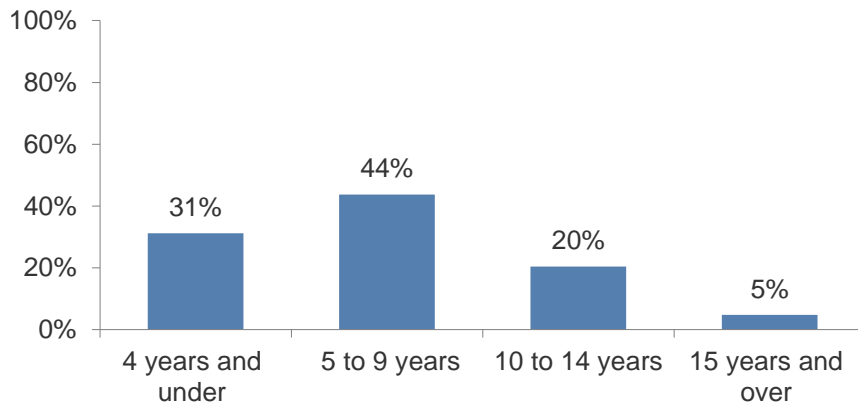
**Figure 10. Responses to "Who are you here with today? (Select all that apply)"**



N = 216

Respondents were asked the age(s) of the youth with whom they were visiting. Ages ranged from 1 year old to 17 years old, with nearly half (44%) between the ages of 5 and 9 years old (See Figure 11). The mean and median ages were 7 years old.

**Figure 11. Age of Children Visiting**

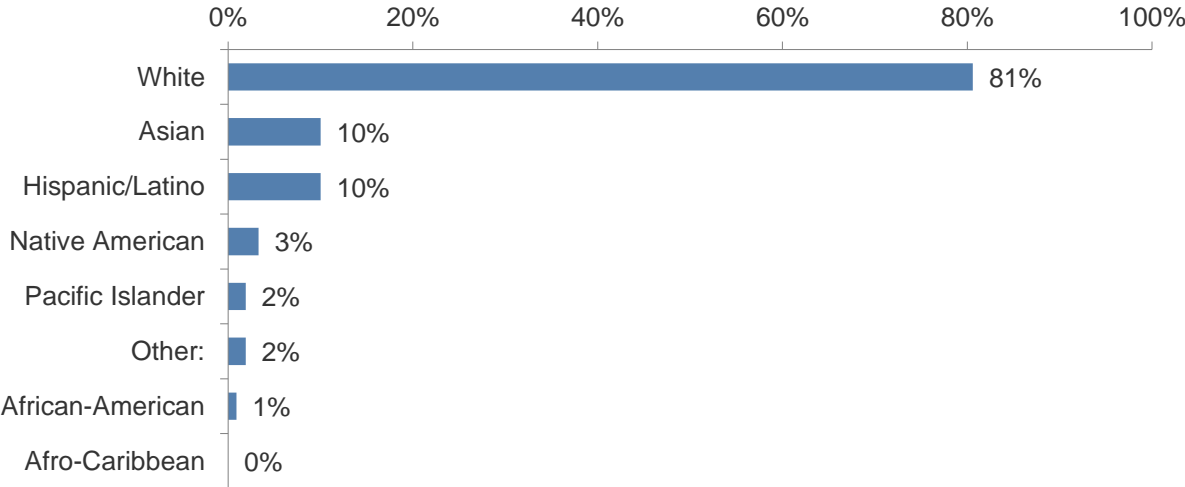


N = 295

Respondents were invited to write their race and/or ethnic origin on the survey. We then used the U.S. Census categories to code the responses that were provided. More than three-quarters

of those who answered this question identified their race/ethnic origin as White (81%) (See Figure 12). A tenth of respondents indicated they that were Asian (10%) or Hispanic/Latino (10%). A few visitors entered more than one response.

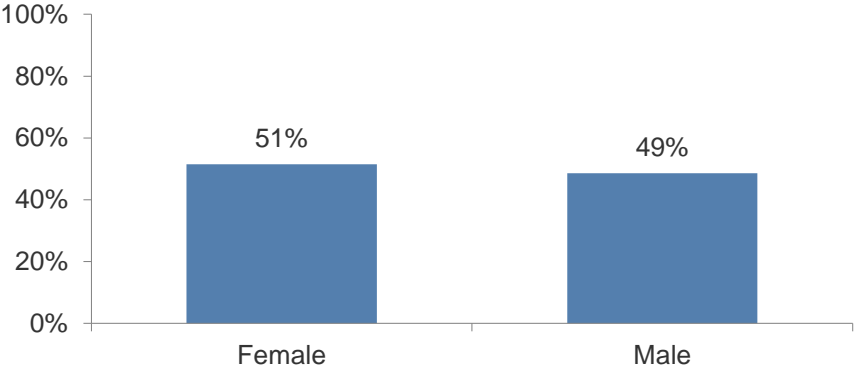
**Figure 12. Respondents' Race/Ethnic Origin**



N = 211

Halfway through data collection, respondents were invited to also fill in their gender on the surveys. Slightly more than half of the respondents (51%) described their gender as female, while the others (49%) described their gender as male (See Figure 13).

**Figure 13. Respondents' Gender**



N = 95

# Results: Girls



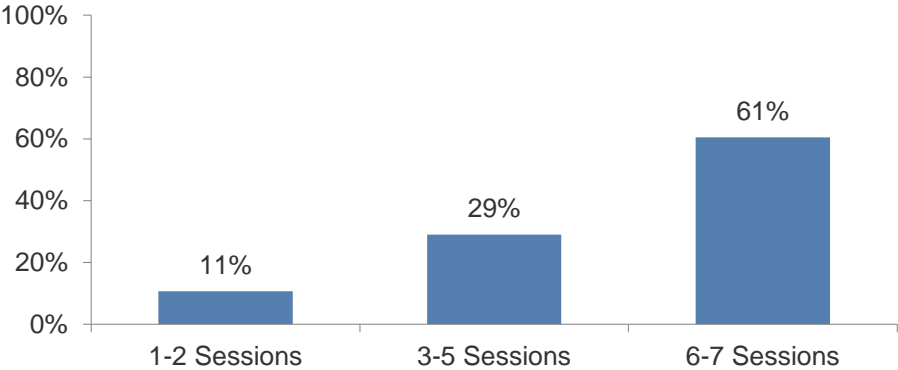


## Results: Girls

### Engagement

For participants to gain knowledge, experience changes in attitude, or exhibit new behaviors from a program, they must engage with it. The evaluation, therefore, sought to determine whether girls engaged in and enjoyed their experience with DOW. A basic measure of engagement is program attendance, and the evaluation found that attendance at DOW sessions was strong. More than half the participants (61%) attended at least six of the seven sessions, and about a third of participants (29%) attended between three and five sessions (See Figure 14.) While DOW sessions were integrated into ongoing Chicas programming, AM staff indicated that girls knew in advance when OMSI staff members were coming to lead DOW activities, making it possible that girls would choose *not* to attend on those days had they not been interested in DOW. Girls might, however, miss some sessions for reasons unrelated to engagement, such as scheduling conflicts with other activities (e.g. math club or volunteering at the food bank).

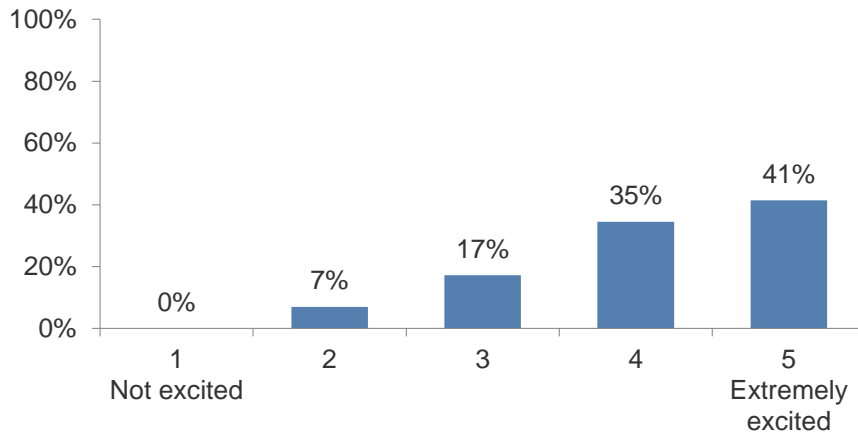
Figure 14. Number of Sessions Attended



N = 38

Girls were excited about DOW before the program began. When asked to rate their level of excitement on the pre-program survey, three-quarters of survey respondents (76%) reported a “4” or “5” on a 1–5 scale (ranging from Not excited to Extremely excited) (See Figure 15).

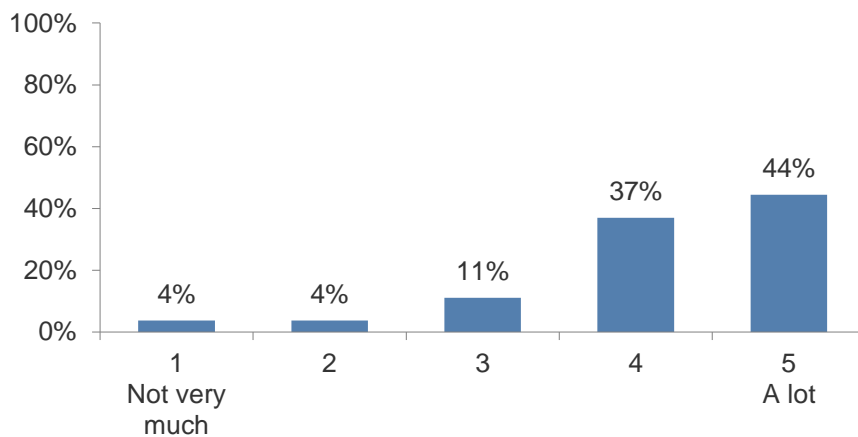
**Figure 15. Pre-Program Levels of Excitement**



N = 29

At the end of the program, girls reported that they had enjoyed DOW. On the post-program survey, more than three-quarters of respondents (81%) rated their enjoyment at the high end of a 1–5 scale (1 = Not very much and 5 = A lot) (See Figure 16). Ratings were relatively evenly split between “4” (37%) and “5” (44%).

**Figure 16. Enjoyment**



N = 29

In order to better understand which components of the program girls found engaging, we asked them 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. In the post-program survey and focus groups, we asked respondents which aspect actually *was* the most fun.

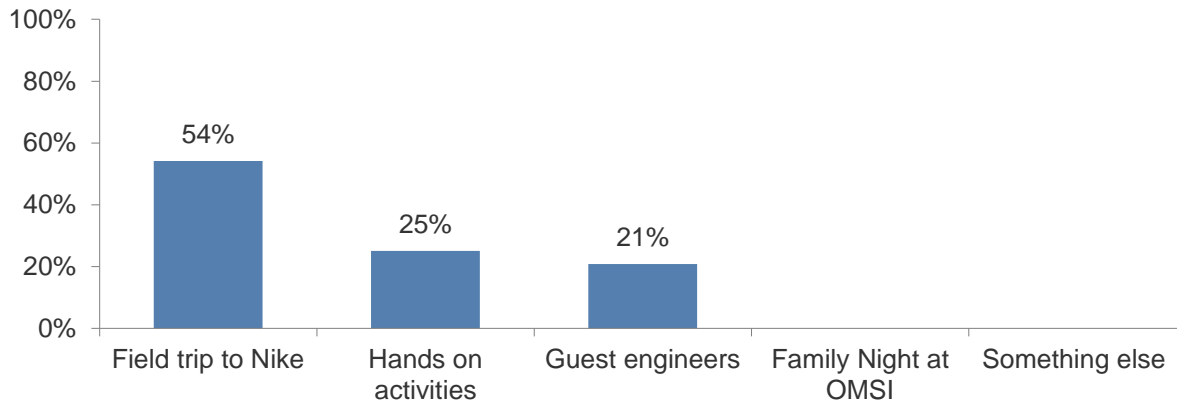
In the pre-program survey, more than a third of responses (38%) predicted that the activities would be the most fun part of DOW (See Table 1). Another third of responses (30%) focused on learning, while others related to field trips (19%) and socializing with friends (11%).

**Table 1. Responses to: "What do you think will be the most fun part of this program?"**

| Response Category | % of Responses (N=37) |
|-------------------|-----------------------|
| Activities        | 38%                   |
| Learning          | 30%                   |
| Field trips       | 19%                   |
| Socializing       | 11%                   |
| Other             | 3%                    |

In the post-program survey, more than half of respondents (54%) reported that the field trip to Nike was the most fun part of the DOW program. About a quarter reported that they most enjoyed the hands-on activities (25%) and 21% named the guest engineers (See Figure 17).

Figure 17. Most Fun Part of DOW



N = 24

Survey respondents reported that the Nike field trip was fun because they got an inside view of the factory and were the first to see new shoe designs.

*Because we got to see the factory.*

*Miraste los nuevo zapatos y mirar los maquinas (You saw the new shoes and seeing the machines).*

*Porque fuimos las primeras en saber un diseño [nuevo] (Because we were the first to see a [new] design).*

*Because we got to see shoes that weren't out yet.*

Girls participating in focus groups also reported that the Nike trip was the aspect of DOW they most enjoyed. Their comments echoed survey responses, with seeing new designs and getting an inside view of the factory named as reasons that the trip was a favorite.

*[I liked] the trip to Nike—we got to see the new shoes before they came out. The brand new shoes.*

*They were designing the shoes and making the air pockets. Engineering is about learning and how to make stuff and also design. We watched them make the shoes.*

*We went to Nike: wear little shoes, ear plugs.*

Focus group participants also reported that they liked the activities, specifically mentioning the windmill, shake table, and water activities as well as listening to whale sounds and building things for friends.

*I liked when we build stuff...I mean like, that time when we built...The air things—the windmills...we made them spin...and also when we got to design things.*

*The one that I liked: the windmill...[the guest engineer] says that that created electricity and I liked that activity.*

*[I liked how] it was, like, activities you can get a little messy with... have fun with our friends.*

It was clear from the focus groups that participants enjoyed that the activities presented real-world problems that challenged them to figure out solutions. In addition, AM staff members reported that they observed high levels of engagement during the DOW sessions and reflected that the hands-on nature of the activities fostered engagement and enthusiasm.

*Having interactive activities [made DOW engaging]. Because the girls were not sitting down, they were actually doing something. This specific group of girls do not like to be sitting down and listening to somebody talking and doing nothing. So always having the sessions where they were able to create something, build something, or do something with their hands, moving around. That definitely was the key to engage them in this project.*

AM staff members also said that girls enjoyed being able to work with their friends and that the activities were challenging. They noted that the girls felt proud to successfully complete the activities.

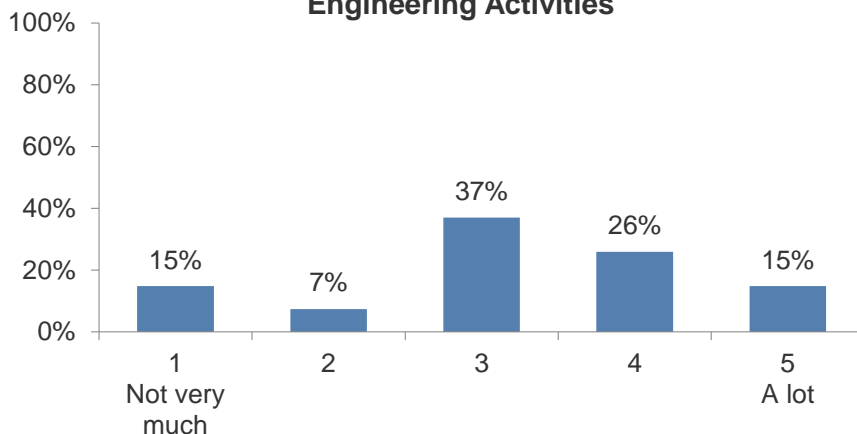
In the focus groups, it was also clear that girls had developed relationships with the OMSI staff members and felt connected to them. AM staff members echoed this finding, noting that the OMSI facilitators served as role models for the girls and were highly effective in leading the activities and setting the overall tone for the sessions.

*What made a big difference was the staff at OMSI. They made the activities really engaging and fun. They really acknowledged their audience and made sure they were addressing and making it relevant to [the girls].*

*The presenters were Latinas, and they were female. I think that was also crucial for the students to be able to make that connection and see, ‘OK, well, she is a Latina and she is doing this. That means that I am able to do that as well.’*

Although girls enjoyed DOW, they reported a more moderate level of interest in continuing with engineering. On the post-program survey, more than a third of respondents (41%) rated their interest as “4” or “5” on a scale from 1 (Not very much) to 5 (A lot) (See Figure 18). A third of respondents (37%) rated their level of interest as a “3,” while fewer than a quarter (22%) rated their interest as a “1” or “2.”

**Figure 18. Respondents' Interest in Doing More Engineering Activities**



N = 27

AM staff members observed that not all girls were interested in careers in engineering or other STEM fields but noted that a lack of career interest did not diminish girls’ enjoyment of the DOW sessions.

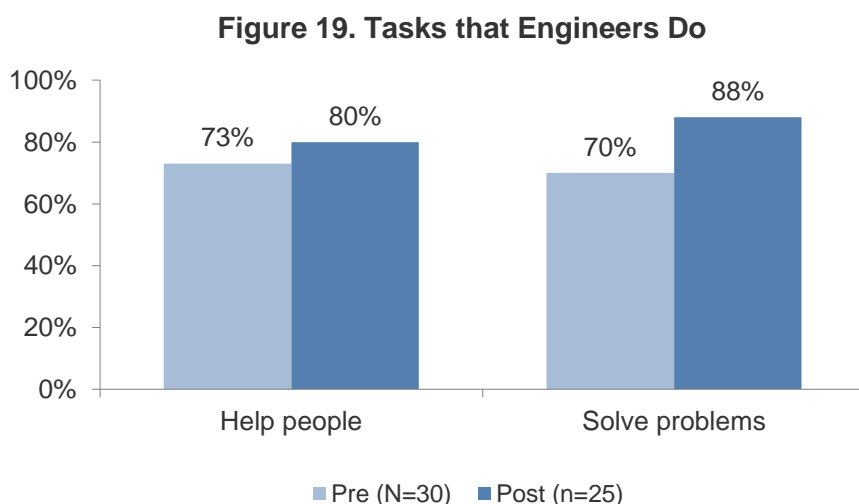
*When we would ask the students, “How many of you want to be engineers?” or “How many of you want to do...” and we would throw out the names of some of those fields, not necessarily all of the students were into that field. But they were not like, “I don’t*

want to do this activity” or they were not like...not showing up for the sessions when we told them OMSI was going to be there.

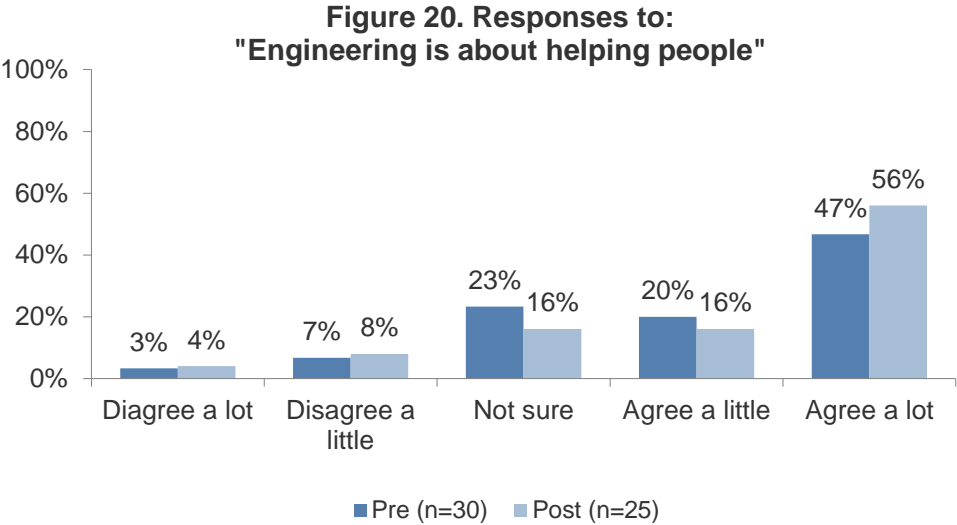
We also asked girls about their interest in continuing to do engineering activities such as those they did in DOW. They expressed moderate interest in continuing their engagement with DOW, specifically noting having enjoyed the activities and doing things with their friends. Respondents did not, however, seem to draw a connection between DOW activities and other engineering activities (or the field of engineering). They had little to say about their interest in engineering activities beyond DOW.

### Knowledge

DOW sought to build girls’ understanding that engineers help people and contribute to solving problems across the world. To assess girls’ knowledge on this topic, the pre-program and post-program surveys presented 17 tasks that people might do as parts of their job and asked respondents to circle the items they thought that engineers do. About three-quarters of respondents circled “Help people” in both the pre-program survey (73%) and the post-program survey (80%) (See Figure 19). Slightly fewer respondents circled “Solve problems” in the pre-program survey (70%) and a somewhat greater number of respondents did so in the post-program survey (88%). These differences were not statistically significant. These data suggest that girls entered and exited the program with a high level of awareness that engineers help people and solve problems.



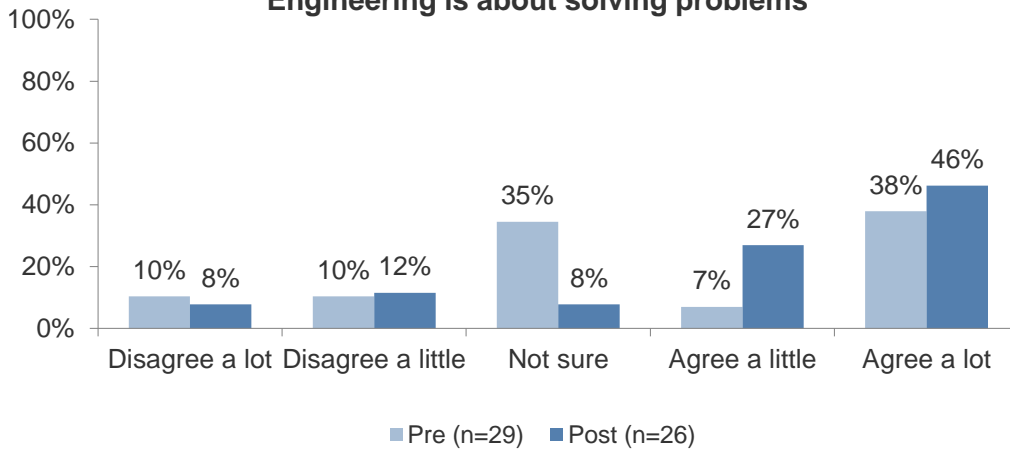
The surveys also asked girls to rate their agreement with the statement, “Engineering is about helping people.” On a scale from “Disagree a lot” to “Agree a lot,” just fewer than half the respondents on the pre-program survey (47%) rated their agreement as “Agree a lot” compared with a bit more than half (56%) on the post-program survey. This change was not statistically significant (See Figure 20). As with the survey items discussed just above, these data suggest that respondents began and exited the program with relatively high awareness that engineering is about helping people.



Girls were also asked to rate their agreement with the statement, “Engineering is about solving problems.” On the pre-program survey, more than a third of respondents (35%) rated their agreement as “Not sure” and just fewer than half of respondents (45%) rated their agreement as “Agree a little” or “Agree a lot” (See Figure 21). On the post-program survey, very few respondents (8%) rated their agreement as “Not sure,” while nearly three-fourths (73%) selected “Agree a little” or “Agree a lot.” While these changes were not statistically significant, they seem to suggest that once they had completed the program, a greater number of girls were aware that engineers solve problems.



**Figure 21. Response to: "Engineering is about solving problems"**



Respondents were asked to explain engineering in their own words in both the pre-program and post-program surveys. Of the 23 respondents who completed both surveys, 16 answered this specific item in both surveys. (Three respondents skipped the question in both surveys, and four respondents answered the question in the pre-program survey but skipped the item in the post-program survey.) The complete set of responses is included in Appendix E and a summary provided in Table 2.

Five respondents (labeled as Group A) indicated on the pre-survey that they did not know what engineering was, then provided a response in the post-program survey. These post-program responses described engineering as fun and interesting, explained that engineering involves technology, and noted that engineers work on projects.

Eight respondents (labeled as Group B) described engineering in the pre- and post-program surveys. These pre-program responses discussed making and building things and focused on design, invention, and discovery. One response discussed engineering as making people’s lives easier, while two others provided more general responses indicating that engineering is fun and requires continued education.

We compared respondents’ pre-program and post-program responses to identify themes across the group. While no overall patterns emerged, we did observe changes at an individual level. Two respondents who had discussed making or building things in their pre-program responses

mentioned helping people in their post-program responses. Two others provided more personal responses in the post-program survey, communicating that engineering was “interesting” or “marvelous” rather than just describing it. Another respondent provided a more specific answer in the post-program survey than in the pre-program survey, noting that engineering was “fun” in her pre-program answer and that engineers make things in her post-program response.

Finally, one respondent (labeled as Group C) provided less detail in the post-program response than in her pre-program response. This respondent described engineering in terms of building things on the pre-program survey, but on her post-program survey indicated that she didn’t know what engineering was.

**Table 2. Summary of responses to: “What is engineering?”**

| Group | Number of respondents | Pre-program survey responses                                                                                                                                                                                                          | Post-program survey responses                                                                                                                                                                                                                                           |
|-------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A     | 5                     | Stated that they did not know what engineering is                                                                                                                                                                                     | Described engineering as: <ul style="list-style-type: none"> <li>• Fun</li> <li>• Interesting</li> <li>• Involving technology</li> <li>• Working on projects</li> </ul>                                                                                                 |
| B     | 9                     | Described engineering as: <ul style="list-style-type: none"> <li>• Making and building</li> <li>• Design, invention and/or discovery</li> <li>• Making people’s lives easier</li> <li>• Fun</li> <li>• Requiring education</li> </ul> | Changes noted at individual level: <ul style="list-style-type: none"> <li>• Two respondents indicated that engineers help people</li> <li>• Two respondents indicated that engineering is interesting or marvelous</li> <li>• One response was more specific</li> </ul> |
| C     | 1                     | Described engineering as building                                                                                                                                                                                                     | Stated that she didn’t know what engineering is                                                                                                                                                                                                                         |

We asked girls to provide three examples of what engineers do on both the pre-program and post-program surveys. Of the 23 respondents who completed both surveys, 21 answered both questions. (One respondent skipped the question in both surveys, and one respondent answered the question in the pre-program survey but skipped it on the post-program survey). This seemed to indicate that respondents felt more able to articulate the activities of engineers than to describe engineering in a more general way. The complete set of responses is in Appendix F and a summary provided in Table 3.

**Table 3. Summary of responses to: “What are three examples of what engineers do?”**

| Group | Number of respondents | Pre-program survey responses                                                                                                                                                                                                                                            | Post-program survey responses                                                                                                                                                                                                                                           |
|-------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A     | 1                     | Stated that she did not know any examples                                                                                                                                                                                                                               | Stated that she did not know any examples                                                                                                                                                                                                                               |
| B     | 6                     | Stated that they did not know any examples                                                                                                                                                                                                                              | Provided examples that focused on: <ul style="list-style-type: none"> <li>• Building, making, and fixing things</li> <li>• Design, invention, and experimentation</li> <li>• Helping people</li> <li>• Working with others</li> </ul>                                   |
| C     | 6                     | Provided one or two examples that focused on: <ul style="list-style-type: none"> <li>• Building things</li> <li>• Technology</li> </ul>                                                                                                                                 | Provided a greater number of examples and broadened focus to include: <ul style="list-style-type: none"> <li>• Problem-solving</li> <li>• Helping others</li> <li>• Teamwork</li> <li>• Science and math</li> <li>• Persistence</li> </ul>                              |
| D     | 8                     | Provided two or three examples that focused on: <ul style="list-style-type: none"> <li>• Creating, designing, and inventing</li> <li>• Building, making, and fixing things</li> <li>• Helping others</li> <li>• Working together</li> <li>• Solving problems</li> </ul> | Provided two or three examples that focused on: <ul style="list-style-type: none"> <li>• Creating, designing, and inventing</li> <li>• Building, making, and fixing things</li> <li>• Helping others</li> <li>• Working together</li> <li>• Solving problems</li> </ul> |

Just one respondent of the 21 (labeled as Group A) indicated on both surveys that she did not know any examples of what engineers do. Six respondents (labeled as Group B) indicated on the pre-program survey that they could not give any examples. Each of these respondents provided three examples on the post-program survey, discussing themes including building, making, and fixing things; design, invention, and experimentation; helping people; and working with others.

Another group of six respondents (labeled as Group C) provided one or two examples on the pre-program survey and three examples on the post-program survey. Those pre-program responses focused on building things and technology, while the scope of the post-program

responses expanded to include problem-solving, helping others, teamwork, science, math, and themes of persistence such as working hard and not giving up.

Finally, eight respondents (labeled as Group D) provided two or three examples in both the pre-program and post-program surveys. These responses reflected themes of creating, designing, and inventing; building, making, and fixing things; helping others and making things safe or better; working together; and solving problems.

To triangulate data, we also asked girls participating in the focus group to collectively list words that describe engineering. Together they generated the following list of words:

- *Teamwork*
- *Work hard*
- *Helping people*
- *Having fun*
- *Designing*
- *Building*
- *Being creative*
- *Solving problems*
- *Helping the world*
- *Make it a better place*

Their conversation during this activity strongly reflected engineering as a social, altruistic activity.

*They help the world by helping others. By building stuff because ... windshields, I guess. Like the school. If there was no school we wouldn't be here, we wouldn't learn. If there were no buildings and (people couldn't) make stuff there would've been no jobs.*

*Teamwork, working hard, not stealing other peoples' ideas. Doing your own thing and helping the world be a better place. Creating.*

*They can make something for someone who's, like, handicapped.*

*They're thinking of others.*

*When they try to design bridges for other people, they have to solve problems for the height and weight.*

*They would also help animals because whatever they build, if it's close to where animals live, they make sure it wouldn't be in their habitat, and if was in their habitat, they would make sure that it wouldn't hurt them.*

*I didn't know that engineering could be that fun.*

Finally, we asked AM staff members what they felt the girls had learned or gained from their participation in DOW. They emphasized teamwork—noting that the activities were conducted in groups—and exposure to and encouragement in pursuing traditionally male-dominated careers.

*Definitely teamwork. I would say that was a big component because all of the activities were involved with teamwork.*

*The girls being able to go to a career that is mainly dominated by guys at this point. I think that was one of the biggest thing. Because the girls...when they brought presenters and seeing a female presenter, they would come sometimes and talk to me and say they can be intimidated to be in a career where there's only guys. But they would say, "I really liked doing this, and it was related with STEM, so I think I'm going to follow it up and see how that goes."*

## **Behavior**

By asking girls who participated in focus groups to reflect on their process, we hoped to determine whether participants demonstrated persistence when engaging in DOW engineering activities. Though these are indirect data, they nonetheless provide insights into girls' perspectives on how they approached activities.

Most focus group participants indicated that they had, in fact, modified or added to their designs during DOW activities. They described these iterations as ways to figure out why things don't work and to improve on functional designs. They also described the process of changing designs and trying new elements. It was especially striking that girls seemed to see iteration as

part of the process of coming up with a design that successfully addressed the problem or challenge they were given in the specific activity.

*When they did the experiment, you try it out, and if it doesn't work, you try it again. You do it different. You make a different one. Try different materials. You could probably [think], "Oh, I forgot to put this," and then you add it.*

*[...]instead of putting everything all together in one, you can put one thing, and if it works, then add another, and then you see.*

*If we kept doing [the activities], the more we do it the better we can get.*

It was also interesting to note that many focus group participants reported that they wanted to continue iterating during DOW sessions but ran out of time.

*We were out of time. If I had more time I would see what was wrong with it and fix it. Add something to it.*

Focus group participants were also asked about strategies they had learned in DOW to deal with failure. They quickly and confidently worked together to generate the following list:

- *Calm down*
- *Deep breaths*
- *Work with people—get ideas from that*
- *Sing*
- *Dance*
- *Go to sleep*
- *Walk/run*
- *Scream into a pillow*
- *Use a stress ball*
- *Talk*
- *Breathe*

When asked about dealing with failure, focus group participants offered the following reflections:

*We also learned that not everything works on the first try.*

*[Engineers] find their mistakes and they would fix their mistake and then see if it works.*

*Try different materials or different things.*

*You kind of get frustrated and you have to fix it again.*

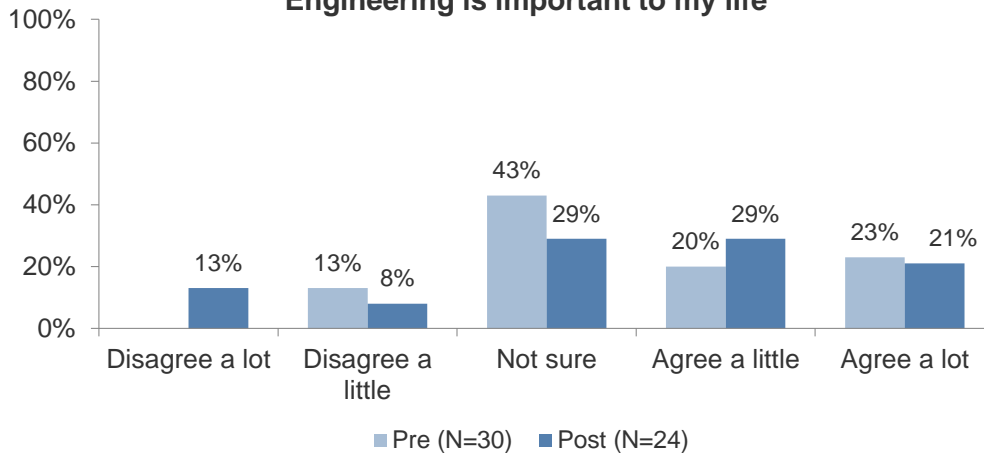
Overall, focus group participants demonstrated that DOW successfully conveyed a message of empowerment. Girls understood that they could do the engineering activities in DOW, even when those activities were challenging, and that they didn't have to get things "right" on the first try. They demonstrated an understanding that iteration and persistence were part of the engineering process and showed awareness of strategies they could use when they got stuck.

### **Attitude**

The evaluation sought to determine the extent to which participants viewed engineering work as valuable. The data indicate that girls placed a moderate level of importance on engineering in the context of their lives.

Pre- and post-program surveys asked girls to rate their level of agreement that "Engineering is important to my life." In the pre-program survey, more than a third of respondents (43%) selected "Agree a lot" or "Agree a little" (See Figure 22). An equal number (43%) selected "Not sure." In the post-program survey, half of respondents (50%) selected "Agree a lot" or "Agree a little" and nearly a third (29%) selected "Not sure." No statistically significant differences were observed in these data.

**Figure 22. Responses to:  
"Engineering is important to my life"**



Girls were also asked to explain their ratings. Respondents who agreed with the statement “engineering is important to my life” cited engineers making useful things and helping people. Respondents who disagreed noted that they didn’t personally like to do engineering activities or that they didn’t anticipate doing engineering in the future. These findings were echoed in the discussion with participants during the focus groups. When asked about how important engineering was in their lives, girls paused to think and then expressed lukewarm agreement that engineering is important. They required additional time and thinking to come up with examples of *why* it was important, mostly naming tangible objects they use that were designed by engineers.

*Yes [engineering is] important – ‘cause then how would I have this phone?*

*Like me how I hurt my foot and [engineers] designed these ... [crutches].*

*[Engineering] kind of impacts everyone because your clothes, the clothes that you are wearing are engineered.*

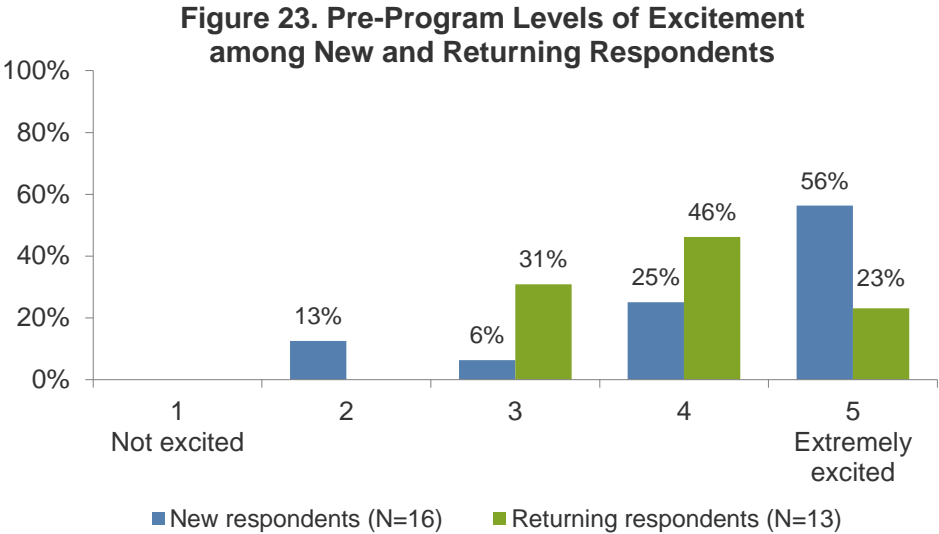
These data indicate that participants identified multiple types of products that engineers are involved in designing; they did not, however, articulate multiple domains (beyond product design) in which engineers contribute to their own lives or to society. They also did not express the influence of engineers across people’s lives or in society.



**Comparison of New and Returning Respondents**

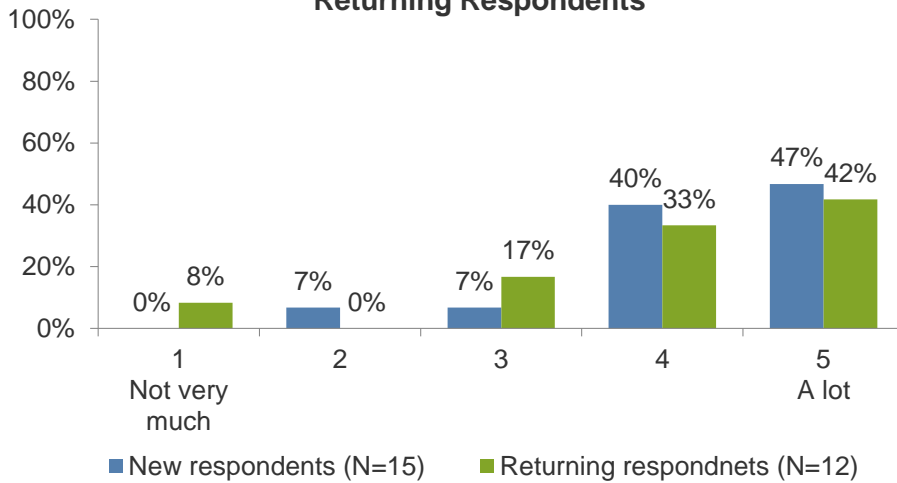
As noted on page 9, 45% of participants had participated in DOW during Year 3 of the program. The evaluation sought to determine whether differences existed between new and returning girls’ responses to the DOW program. To enhance clarity in this section, we present data from the new girls in blue and data from returning girls in green.

*Engagement.* One possible difference was observed when girls were asked to rate their level of excitement prior to beginning the program. In comparing responses from new and returning girls, we found that a higher percentage of new respondents (56%) rated their level of excitement as a “5” (Extremely excited) than did returning respondents (23%) (See Figure 23). No statistically significant differences were observed in these data.



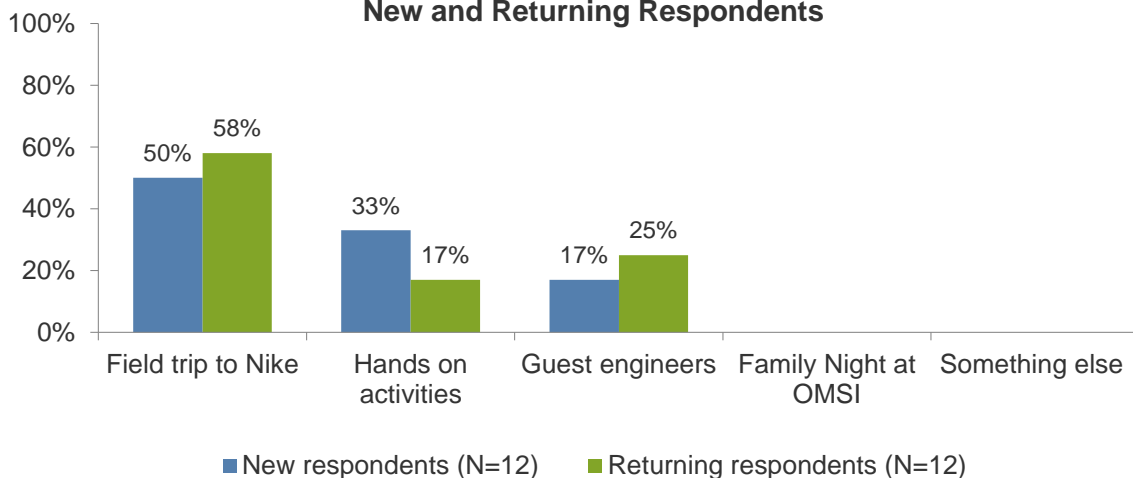
While levels of excitement may have differed at the outset of the program, both new and returning girls reported enjoying DOW. A strong majority of new respondents (87%) and three-quarters of returning respondents (75%) rated their enjoyment at the high end of a 1–5 scale (1 = Not very much and 5 = A lot) (See Figure 24).

**Figure 24. Level of Enjoyment among New and Returning Respondents**



In the post-program survey, about half of new respondents (50%) and a higher number of returning respondents (58%) reported the Nike field trip to be the most fun part of DOW (See Figure 25). Among new respondents, the DOW activities ranked second (33% of new girls identified this aspect as the most fun) and the guest engineers ranked third (with 17% of new girls). In contrast, the guest engineers were ranked second by returning girls (25% of returning girls identified this aspect as most fun) and the DOW activities were ranked third (with 17% of returning girls).

**Figure 25. Most Fun Part of DOW among New and Returning Respondents**



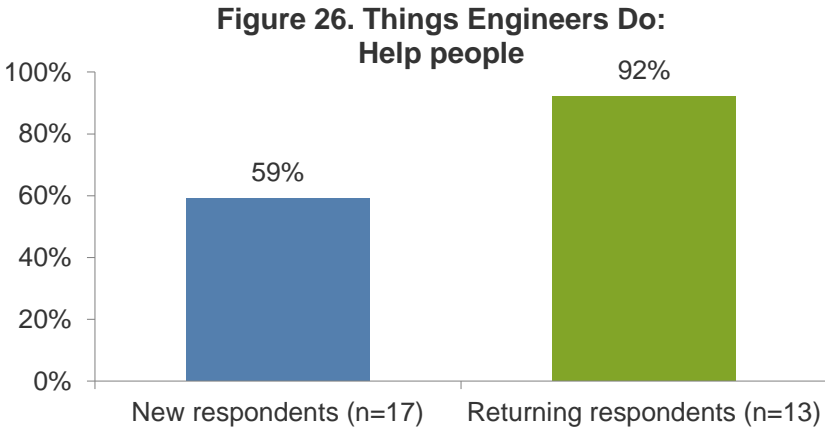
While these differences were not statistically significant, they raise the question of whether new and returning girls had differing experiences of these components. For example, returning girls may have enjoyed visits by the guest engineers even more than the new girls, since at least one

guest engineer had also visited the prior year. In contrast, returning girls may have enjoyed the activities somewhat less if they had been repeated from the prior year. While most activities in Year 4 were different from those in Year 3, this might not have always been apparent to the girls since the activities follow a similar format and structure. One returning respondent reflected on the activities in Year 4 compared with Year 3:

*The projects were kind of like the same, every time, they just had a little kick to them, but I wish they would do different ones all the time... Like the cards and all that.*

*Knowledge: Differences in Pre-Program Levels of Understanding.* The data suggest that returning girls entered DOW this year with greater knowledge than the new girls that engineers help people. This is consistent with Y3 findings that by the end of the program, girls were able to articulate the altruistic nature of engineering careers.

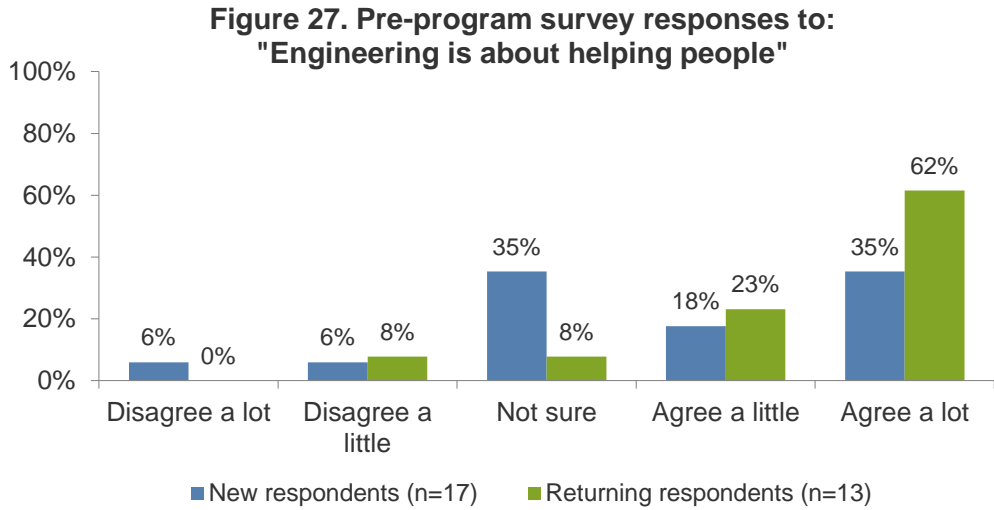
On the pre-program survey item that presented 17 tasks that people might do as part of their job, nearly all returning respondents (92%) circled “Help people” compared with fewer than two-thirds of new respondents (59%) (See Figure 26). This difference is statistically significant.



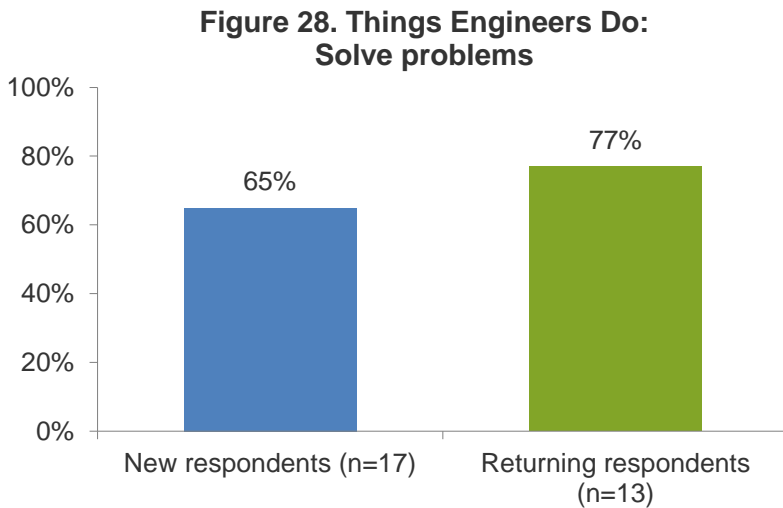
$X^2(1, 30) = 4.224, p=.04$

On the pre-program survey item that asked girls to rate their agreement with the statement, “Engineering is about helping people,” nearly two-thirds of returning respondents (62%) rated their agreement as “Agree a lot” compared to about a third of

new respondents (35%) (See Figure 27). In addition, more than a third of new respondents (35%) rated their agreement as “Not sure” compared with just a few returning respondents (8%). These differences were not statistically significant.

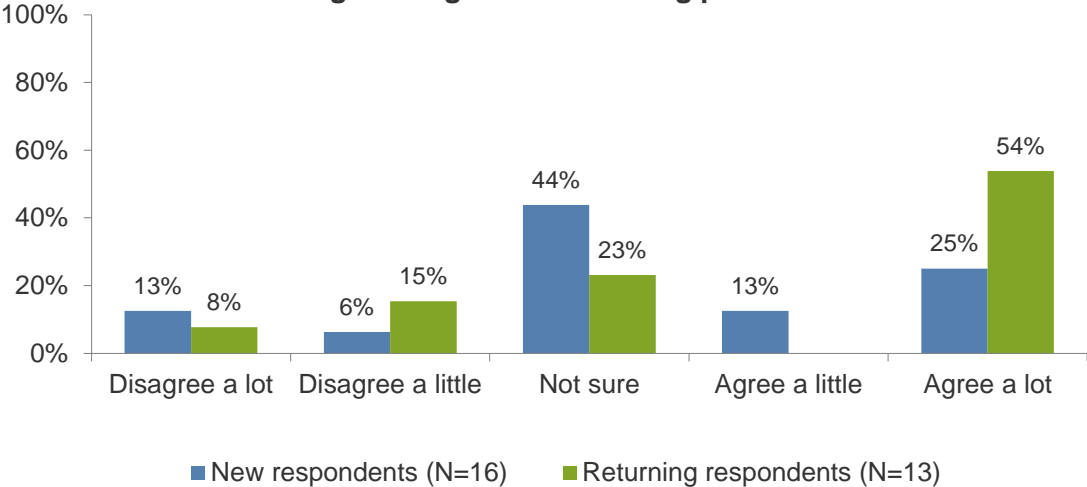


Returning girls may have also entered the program with greater knowledge that engineers solve problems than did new girls. This construct was not measured in Year 3. On the pre-program survey, more than three-quarters of returning respondents (77%) circled “Solve problems” as a task that engineers do, compared to about two-thirds of new respondents (65%) (See Figure 28). This difference was not statistically significant.



When asked to rate their agreement with the statement, “Engineering is about solving problems,” more than half of returning respondents (54%) rated their agreement as “Agree a lot” compared with just a quarter of new respondents (25%) who did so (See Figure 29). In addition, nearly half of new respondents rated their agreement as “Not sure” (44%) compared with fewer than a quarter of returning respondents (23%). These differences, however, are not statistically significant.

**Figure 29. Pre-survey responses to: "Engineering is about solving problems"**



Respondents were asked to explain engineering in their own words in both the pre- and post-program surveys. Nearly all returning respondents (90%) provided an explanation of engineering. In contrast, fewer than two-thirds of new respondents (60%) provided an answer, with the others leaving the item blank or indicating that they did not know what engineering was. Most new respondents who described engineering referenced building or creating things.

*Engineering is a person who creates or makes things/stuff.*

*I would say engineering is creating something.*

*Engineering is (when) a person designs or creates things.*

Many returning respondents also referenced creating new things, while a few discussed solving problems or helping people.

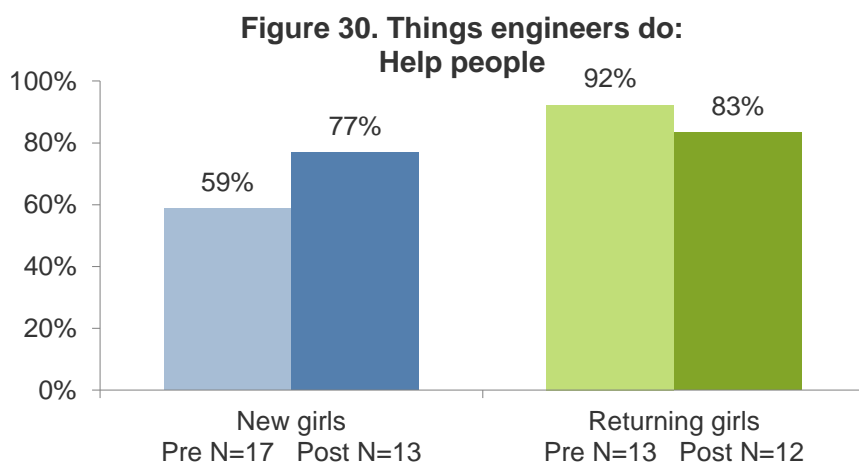
*Engineering is a job that people can create or discover new things.*

*I think it's about a person who makes things.*

*Engineering is about solving problems.*

*It's a person who comes up with cool gadgets to make peoples' life easier.*

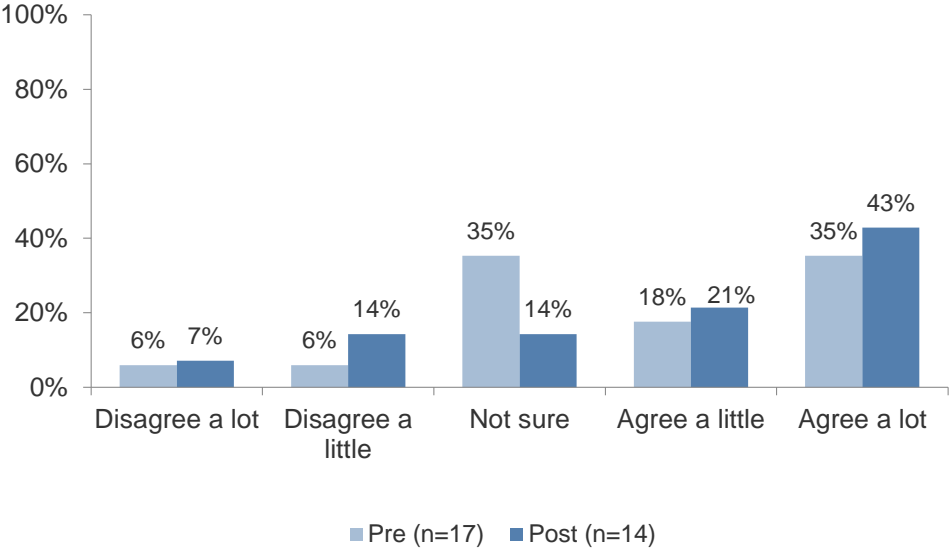
**Knowledge: Changes During DOW.** Comparing the data from new and returning respondents can shed additional light on changes in knowledge that may have occurred over the course of the DOW program. On the item that presented girls with 17 job-related tasks, the percentage of new respondents who selected “Help people” increased from fewer than two-thirds (59%) on the pre-program survey compared to more than three-quarters (77%) on the post-program survey (See Figure 30). Among returning respondents, however, nearly all (92%) selected it on the pre-program survey and more than three-quarters (83%) did on the post-program survey. No statistically significant differences were observed.



Pre-program and post-program data were also compared to identify changes in respondents’ ratings of agreement with the statement, “Engineering is about helping people.” It appears that new respondents may have demonstrated a slight shift toward the higher end of a 1–5 scale (where 1 = Disagree a lot and 5 = Agree a lot), as fewer respondents rated their agreement as

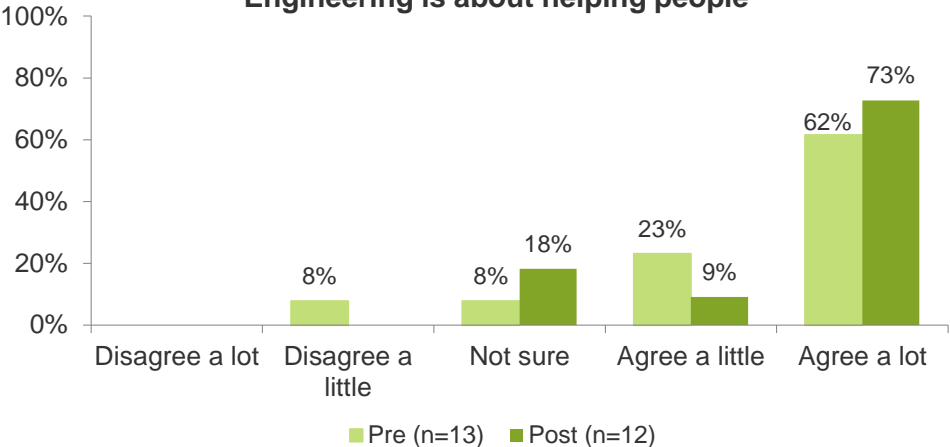
“Not sure” (35% for pre-program survey, 14% for post-program survey) (See Figure 31). These changes are not statistically significant.

**Figure 31. New respondents:  
"Engineering is about helping people"**

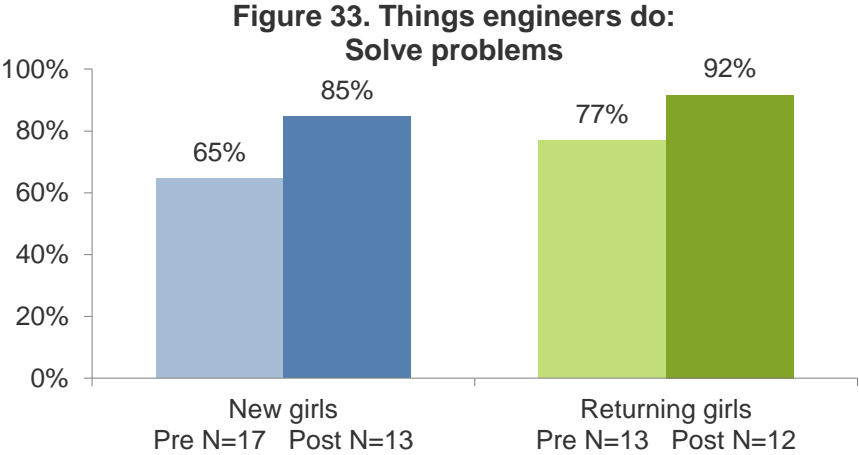


It also appears that returning respondents may have shifted slightly toward the higher end of the scale, as nearly two-thirds (62%) rated their agreement as “Agree a lot” on the pre-program survey compared with nearly three-quarters (73%) on the post-program survey (See Figure 32). No statistically significant differences were observed.

**Figure 32. Returning respondents:  
"Engineering is about helping people"**



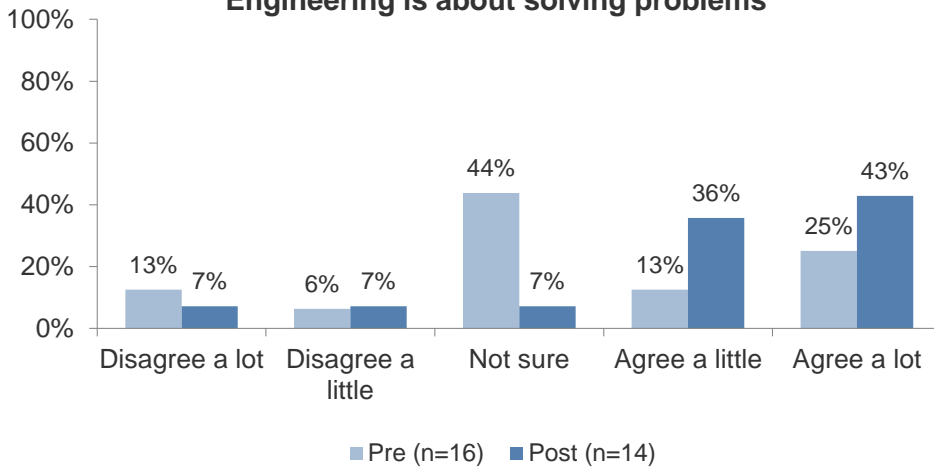
The data also suggest small increases in the knowledge that engineers solve problems over the course of this year’s DOW program. On the item that presented girls with 17 job-related tasks, the percentage of new respondents who selected “Solve problems” increased from about two-thirds (65%) on the pre-program survey to more than three-quarters (85%) on the post-program survey (See Figure 33). A similar change is seen among returning respondents, with more than three-quarters selecting “Solve problems” in the pre-program survey (77%) and nearly all (92%) in the post-program respondents. These changes, however, are not statistically significant.



When asked to rate their agreement that “Engineers solve problems” on a scale from “Disagree a lot” to “Agree a lot,” the ratings of new respondents shift from the middle of the scale toward the higher end (See Figure 34). In the pre-program survey, nearly half of new respondents rated their agreement as “Not sure” (44%) compared to very few respondents (7%) in the post-program survey. A greater percentage of new respondents agreed with the statement, up from just over a third (38%) in the pre-program survey to more than three-quarters (77%) in the post-program survey. No statistically significant differences were observed, however.

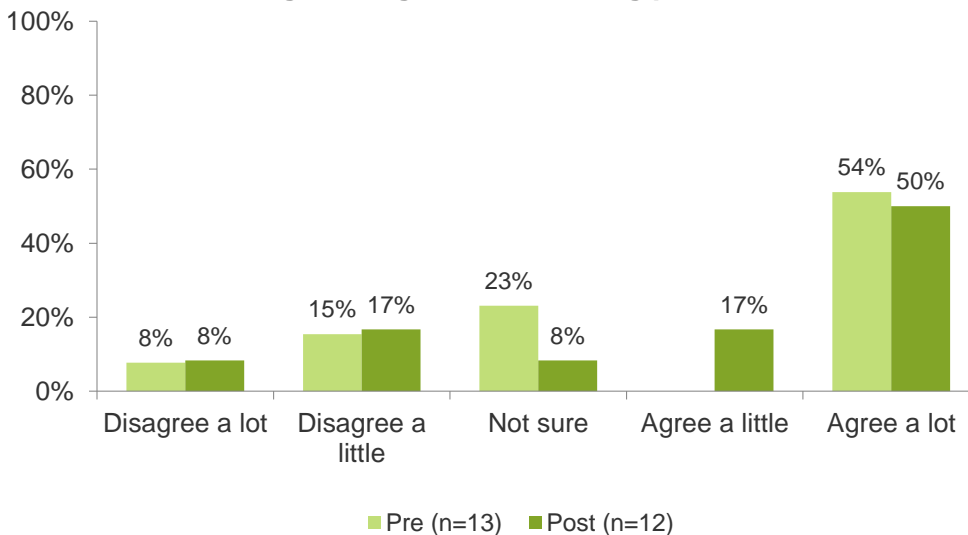


**Figure 34. New respondents:  
"Engineering is about solving problems"**



It is possible that returning respondents may have demonstrated a slight shift toward the higher end of the scale. Slightly more than half the returning respondents (54%) selected “Agree a lot” or “Agree a little” on the pre-program survey, while more than two-thirds did so on the post-program survey (67%) (See Figure 35).

**Figure 35. Returning respondents:  
"Engineering is about solving problems"**



Shifts in understanding can also be examined by comparing survey respondents’ examples of what engineers do. Of the 11 new girls who answered this item on both surveys, eight provided

more examples and/or more specific examples on the post-program survey than on the pre-program survey. Sample responses are provided in Table 4.

**Table 4. Sample responses from new girls to: “What are three examples of what engineers do?”**

| Pre-program survey response        | Post-program survey response                                                                                                                      |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. <i>No lo se (I don't know)</i>  | 1. <i>Engineers design things</i><br>2. <i>Work with all the people</i><br>3. <i>Build things</i>                                                 |
| 1. <i>Construllen (They build)</i> | 1. <i>Actividades (Activities)</i><br>2. <i>Resolver problemas (Solve problems)</i><br>3. <i>Ciencias y matemáticas (Science and mathematics)</i> |
| 1. <i>I don't know</i>             | 1. <i>Design a lot of things</i><br>2. <i>Build things</i><br>3. <i>Invent things</i>                                                             |
| 1. <i>?</i>                        | 1. <i>Fix things</i><br>2. <i>Make things</i><br>3. <i>Help you learn</i>                                                                         |

Of the ten returning girls who completed both pre-program and post-program surveys, five provided more examples on the post-program survey than on the pre-program survey. Three respondents described personal attitudes or qualities on the post-program survey that were not included on the pre-program survey. Sample responses are provided in Table 5.

**Table 5. Sample responses from returning girls to: “What are 3 examples of what engineers do?”**

| Pre-program survey response                                           | Post-program survey response                                                                                                          |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 1. <i>Combierten algo (Transform something)</i>                       | 1. <i>Work hard</i><br>2. <i>Never give up</i><br>3. <i>Learn new things</i>                                                          |
| 1. <i>Build stuff</i><br>2. <i>Plan stuff</i><br>3. <i>Technology</i> | 1. <i>Trabajar juntos (Work together)</i><br>2. <i>Hacen cosas (Make things)</i><br>3. <i>Son inteligentes (They are intelligent)</i> |
| 1. <i>They build technical things</i>                                 | 1. <i>Problem solving</i><br>2. <i>Thinking</i><br>3. <i>Teamwork</i>                                                                 |

**Results:  
Parents/Caregivers**



## Results: Parents/Caregivers

DOW sought to equip parents and caregivers with the knowledge they would need to support their girls' engagement in engineering activities both during and after the DOW program. The OMSI team sought to accomplish this by offering a parent orientation and two workshops (one that addressed gender equity in engineering and one focused on engaging girls in engineering) as well as the FEN and a take-home activity for girls and parents/caregivers to share.

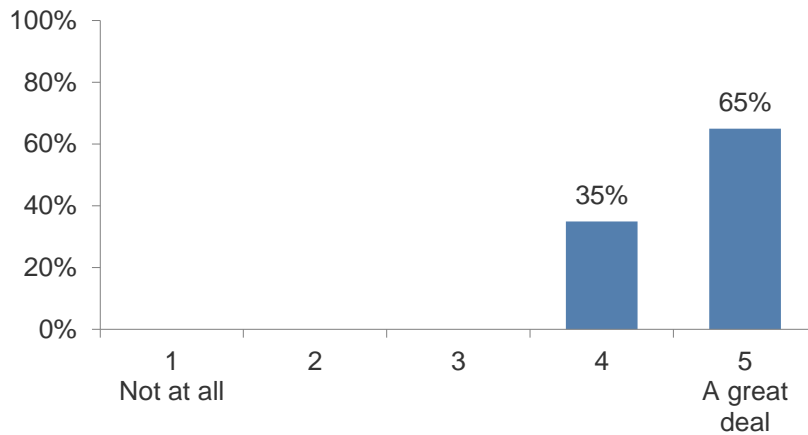
Of the parents/caregivers who attended a DOW workshop, more than three-fourths (84%) had a girl in DOW. This demonstrates improved alignment between the girls and parent/caregiver components of the program compared with Year 3, during which the majority of workshop attendees did not have a girl in DOW.

More than a third of participating girls (40%) had one or more caregivers attending at least one parent session. Though this is fewer than half of the girls, it represents improved engagement from Year 3. OMSI staff and AM staff noted that attendance at parent/caregiver workshops was constrained by parents' and caregivers' work commitments and by the political climate following the 2016 U.S. Presidential election. As one AM staff member explained:

*This year, not just with this program...it was overall...we did have few parents coming out to our workshops in general [...]Not all parents were able to make it due to work, which was one of the barriers that was stopping them from coming because some of the parents do work as late as until 9. So, they were not able to get out of work to participate in the workshops. Also, the climate, the political climate was a big impact with our attendance in general with all of our workshops.*

Those parents and caregivers who attended a workshop reported that they enjoyed the session. Nearly two-thirds of survey respondents (65%) rated their enjoyment of the workshop activities as a "5" on a 1–5 scale, where 1 meant "Not at all" and 5 meant "A great deal" (See Figure 36). The remaining third of respondents (35%) rated their enjoyment as a "4."

**Figure 36. Enjoyment**

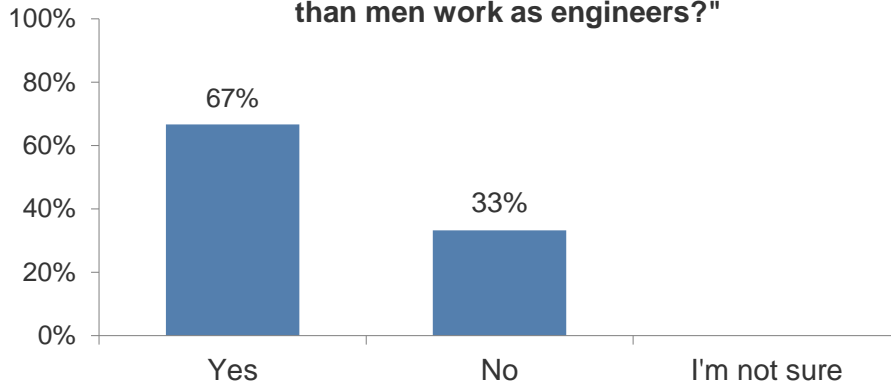


N = 20

AM staff members echoed this finding, noting that they observed parents and caregivers participating actively in the workshops, working together during workshop activities, and demonstrating enthusiasm for the topics discussed.

The vast majority of survey respondents (95%) reported learning something in the workshop. When asked to articulate what they learned, however, few respondents described specific knowledge they had gained. About half of survey respondents provided general comments that they would provide encouragement to their daughters or seek to motivate them. Three of the nine respondents noted that the workshop had helped them learn to teach and support their girls. They did not, however, specify what approaches or ideas that they had learned. Further, six of the nine respondents who attended the workshop about gender equity in engineering indicated they had prior knowledge that fewer women than men work as engineers (See Figure 37).

**Figure 37. Responses to: "Before today's workshop, were you aware that fewer women than men work as engineers?"**



N=9

Four of the 11 respondents from the March workshop on engaging girls in engineering indicated that they had learned how to do the building activity conducted during the workshop and that they valued that aspect of the workshop. When asked what ideas and strategies they had learned for supporting their girls, three of the 11 respondents reported they had learned “ideas and strategies” but did not provide specific examples. Two respondents named doing activities as a strategy; one said that the workshop had provided ideas for future projects but did not specify those ideas.

We were concerned that parents and caregivers may not be comfortable responding to a written survey. Therefore, we triangulated these findings by asking parents and caregivers in focus groups to share what they had learned at the workshops they attended. Eight of the 12 focus group participants reported attending at least one DOW workshop either this or last year, but we found little evidence of specific knowledge gained about engineering or gender inequity. A few focus group participants could, however, describe engineering in specific terms or demonstrate an understanding that engineering is involved in multiple domains.

*No sabía lo que hacían los ingenieros ni que eran diferentes tipos. Antes sabía ingeniero edificios, agrónomo, nada mas. (I didn't know what engineers did or that there were different types. Before I knew that they did buildings, agronomy, nothing else).*

*Como hacer una cirugía (How to perform a surgery).*

*Estructuras podemos formar para hacer un edificio. Como lo puede lograr (Structures we could form to make a building; how to achieve it).*

*El trabajo de como hacer un edificio (The work of making a building).*

*Que hacer en un tsunami, un temblor...es de operaciones (What to do in a tsunami, an earthquake... it's about operations).*

*Nos dijeron de en una cirugía, que hacer ... son unas herramientas que usan que son excelentes ([The workshop presenter] told us about a surgery, what to do ... there are some excellent tools that they use).*

A couple of focus group participants were also able to name personal qualities or attributes involved in engineering, including creativity and solving problems or helping people. In addition, a few female focus group participants discussed prejudice and cultural attitudes around girls and science/engineering in general. These comments appeared to draw on respondents' own experiences and references to the culture in which they grew up rather than on something they had specifically learned through DOW; this may, however, reflect the workshop discussion around the facilitators' and participants' personal experiences. Additionally, few parents or caregivers articulated specific ideas and strategies to support their girls' engagement in engineering, although many group participants discussed the importance of support, motivation, and encouragement for their daughters in general terms.

We asked AM staff members about the learning they observed among workshop participants. They reported that one or two parents/caregivers drew connections between the workshop content and their own lives and activities. For example, AM staff reported that one individual shared having built fences in Mexico and now realizing that that activity was related to STEM.

Overall, the data suggest that workshops may not be the most suitable platform to equip parents and caregivers with the knowledge required to support their girls in pursuing engineering; few parents were available for, or interested in, attending workshops, and the workshops did not seem to convey specific information or strategies that parents and caregivers could identify and articulate.

As noted in the Year 3 evaluation report (Garibay Group, 2016), parents and caregivers with girls in the Chicas program demonstrated a high degree of motivation to support their girls and a high level of engagement with their daughters' education generally. The challenge for a program like DOW is to identify platforms or strategies to leverage these assets and foster specific knowledge around supporting girls in engineering.

We also used focus groups to learn about the extent to which parents/caregivers were aware of DOW and how DOW content had potentially moved into the home context. Only a few participants were aware that their girls were involved with DOW, and the majority had difficulty talking about or recognizing DOW as a program separate from general Chicas activities. On one hand, this finding reflects DOW's successful integration into the Chicas program. On the other hand, however, it demonstrates that parents were not entirely aware that their girls were engaged in a specific program around engineering and were not aware that they themselves had been tapped to be part of a community providing support to the girls. It seems difficult to foster a community of support centered on the girls if key members of that community are not aware of the program and its aims.

Perhaps not surprisingly, however, we found that the parents that did seem to know that their daughters were participating in the DOW program were those who had returning girls. Additionally, these girls—at least during focus groups—were among the most enthusiastic about the program's activities and experiences. This suggests that awareness may be built over time and that DOW might engage the girls themselves in drawing their parents and caregivers into the DOW community.

Turning to parent/caregiver engagement intended to take place beyond AM, we asked parents and caregivers about conversations and activities around engineering that took place in their homes. Only a couple of focus group participants reported that their girls occasionally mentioned doing a science-related activity; no evidence existed of sustained conversations or follow-up investigations related to DOW. Additionally, only two parents recalled that their daughters had brought home an activity. They were not sure what the activity was about, and no one reported doing the activity with their daughters. This finding was supported by information provided by OMSI staff that the take-home activity was not distributed to girls as planned during a DOW session. It was, however, handed out and explained at a later time by AM staff.



Finally, six focus group participants reported that they had visited OMSI for FEN either this or the previous year and were very enthusiastic about the trip and their experiences. Some recalled doing particular activities and were especially appreciative of being able to spend time with their children as part of those trips. There were also indications that they saw OMSI as a fun and educational place for their families, and some participants mentioned the free entrance and transportation as being helpful. They all expressed interest in returning to OMSI with their girls and families.

**Results:  
Adelante Mujeres  
Staff**



## Results: Adelante Mujeres Staff

A third aspect of DOW was providing professional development for AM staff. This PD aimed to build awareness of engineering and gender inequity within the field, deepen AM staff understanding of informal education strategies that can be used to engage girls in engineering activities, and motivate staff to continue using DOW strategies and materials going forward. In Year 4, three AM staff members (from a total of nine staff) engaged in embedded PD activities, meaning that they observed OMSI presenters leading the DOW activities with girls. These three staff members also participated in reflective discussions with the OMSI team. Due to the small sample size and the corresponding difficulty in maintaining respondent confidentiality, we present interview responses and answers to the open-ended, pre-interview questionnaire together in this section.

DOW sought to build, among AM staff, awareness that engineers contribute to solving problems across the world. These staff members did demonstrate awareness of engineering as a creative and social activity. When asked to describe what engineers do in their own words, the AM staff emphasized product design and problem-solving as they related to everyday life as well as in technical endeavors.

*Engineers are designers and innovators, they create different things that are used on a daily basis.*

*Engineers provide solutions to technical problems by using their skills and knowledge in science and mathematics.*

*Engineers are creative-innovative individuals who can either work individually or in a group dynamic to design/enhance tools for corporations, organizations, the community, or self.*

When asked what they learned through their participation in DOW, AM staff members reported a range of takeaways including strengthened communication, coordination, and leadership skills. One staff member reflected on the group facilitation skills and strategies that were learned by watching OMSI staff lead a parent workshop while another staff member reported becoming more familiar with STEM careers through DOW.

*I was aware of how many careers there were, but I didn't know the specific ones. And there was one that was related to the ocean. I can't remember exactly the name of it. But there was a presenter coming and for me it was it was like a "wow" moment because I didn't realize it was connected at all with STEM. [...] [DOW] gave me more exposure to the careers that are related with STEM.*

It is interesting to note that AM staff members seemed to see DOW as a program that encompasses a broad range of STEM topics and careers rather than one focused specifically on engineering.

*The OMSI team provided the Chicas staff with different resources on the STEM field.*

*[DOW was about] exposing students at a young age to STEM fields. More than just any students, it was really targeting minority groups. So, in this case, Latinas. To not only one specific field in STEM, but multiple careers. So, they could have been learning about engineering, they could have been doing about architecture...so many different fields. I think that's what made this program very unique, that the girls learned about multiple careers within the STEM field.*

In addition to building staff awareness of engineering, DOW also aimed to deepen staff members' awareness of gender inequity in engineering. When asked to reflect on their level of awareness at the end of the program and compare it with their level of awareness before their involvement with DOW, all staff members reported increases in awareness. Staff members also provided a number of reasons that gender inequity exists in engineering, including a lack of encouragement for girls to enter the field, a lack of female role models, and a lack of opportunities for women compared with the opportunities available to men. Staff members also discussed sexism in the broader culture. Adelante staff members did not discuss implicit bias as a factor in gender inequity, although this key message was to be conveyed in the reflective discussions.

*Encouragement from family, school, and other mentors to engage in STEM field opportunities.*

*Not having the encouragement/empowerment since they are in grade school about going to a career that is mainly male-dominated also has a big effect.*

*We don't have many women in the engineer careers so it is hard for young girls to have someone to look up, which sadly has an effect when choosing a STEM Career since girls don't have that person they can relate to be their role model.*

*Equitable access/opportunity for women/girls, particularly minority students.*

*In our culture we are taught at a very young age that girls play with dolls and help with cleaning and cooking.*

*Media portrays the boys as the strong ones, those that can build anything. Girls are portrayed as weak.*

A third area of understanding that DOW sought to build was knowledge of informal education strategies to engage girls in engineering. AM staff members reported that their understanding had, in fact, been deepened. When asked for examples, one staff member shared a specific strategy around helping girls understand the role of failure in engineering.

*Stating the importance of failure as part of engineering and as a life skill/lesson.*

Other staff members described the DOW activities as high-quality and useful rather than focusing on specific strategies.

*[I learned] more ideas about hands-on activities that involved critical thinking and are related with engineering careers.*

*OMSI presented different resources on how the facilitators can deliver STEM-related sessions.*

OMSI staff conceptualized a core component of AM staff's professional development taking place through three reflective discussions to be held over the course of the DOW program. OMSI explained that the sessions aimed to impart specific knowledge around engineering and

gender inequity, taking the place of the educational workshops initially envisioned to convey this information. AM staff reported the reflective sessions to be highly beneficial; however, they shared a different perspective on the purpose and nature of the sessions. AM staff described the reflective discussions as time set aside to facilitate clear, ongoing communication about program implementation. They explained that the sessions were important for OMSI to provide updates about how the program was going, for AM staff to provide feedback to OMSI, and for the two teams to plan next steps.

*At each meeting, what [OMSI staff] would do is provide us with a summary of the activities that they did. With that summary, they also provided their own feedback [...] providing us with detailed...why did they think an activity didn't go as well as they thought, what was the behavior during the activity. [...] And asking us for feedback, planning for what is next.*

AM staff emphasized that these face-to-face conversations were important because they cemented the strong partnership at the core of DOW. Staff provided an example of how the meetings helped facilitate the transition: new staff members at both OMSI and AM took on leadership roles in the program and the team used these meetings to figure out new ways of working together. We asked AM staff members how they would describe the reflective discussions (as a check-in meeting, an opportunity for learning, or something else). They strongly reiterated the communication aspect of the meetings and specifically stated that the reflective discussions were *not* PD sessions.

*It was definitely more of like a sharing time, checking in. I wouldn't say they were training or professional development or anything like that.*

While reflective discussions can be used successfully for PD, the data indicate that the reflective discussions included in DOW did not lead to specific reflection on practice or skill building. In addition, there is evidence that the purpose of the reflective discussions was not communicated to AM staff in a way that explicitly positioned the discussions as PD.

Finally, DOW aimed to inspire motivation among staff members to continue using DOW strategies and materials to engage girls in engineering. The data revealed a high level of motivation to continue using certain DOW activities and also showed evidence that those

activities are already being integrated into a range of Chicas after-school sessions and summer camps. AM staff members reported that as their colleagues not involved with DOW heard about the DOW activities—and particularly how much girls enjoyed the activities—they requested information about how they could implement the activities in their *own* after-school sessions. As a result, the staff member most familiar with the DOW activities has become the *de facto* point person, identifying “ice breaker” activities that would be a good fit for different ages and groups of girls and then explaining how to successfully implement them.

*The information and resources that OMSI provided have been very helpful because we have been able to adapt during our summer camps and other program activities.*

*At the Family Engineering Night, there were activities the girls have been doing...like brain-teasers. So, I definitely have been taking advantage of that and bringing them to my other sessions. Some of the girls were not able to make it [to Family Engineering Night]. And for the girls who were not able to figure it out, to see if they could figure it out during the session. Then, that was passed along to the other facilitators as well. I know they were implementing them as well in their sessions with the high school girls and middle school girls as well.*

*The other facilitators in the [after-school] program were able to implement some of the activities that were done during the OMSI sessions in their sessions [...] They were simple activities, I wouldn't go for the big ones. It was like icebreakers that they were doing. Or mini-activities that were done during sessions that were related with STEM. I would be sharing with [the other facilitators] how the girls liked [an activity] and they would ask me if I could explain it and give them more of an explanation of how to do that activity and how to implement it in their session.*

AM staff reported that six additional facilitators have become familiar with some or all of these “ice breaker” activities and have incorporated them into the sessions they lead, including sessions with middle school and high school girls. In addition, one AM staff member involved with DOW, and another staff member not involved, have both implemented more complex activities with the groups they facilitate; both have used the Surgical Solutions activity, and the staff member involved with DOW has also implemented the Base Isolation activity in a session

she facilitated. Altogether, AM staff estimate that all girls involved with Chicas have engaged with at least one DOW activity.

*We have about 500 students, and I know that every single student was exposed to DOW activities.*

This provides evidence that even though only three AM staff members were deeply engaged with DOW and participated in the PD activities, DOW nonetheless has filtered through the organization and permeated the Chicas program. This provides strong evidence that DOW will likely continue to have sustained impact at AM.

While motivation is necessary for continued use of DOW strategies and activities, staff members also need to feel comfortable and confident in implementing those activities to keep doing so after the DOW program has ended. The evaluation found that DOW has, in fact, fostered increased comfort and confidence among the three staff members who have engaged in DOW. Previously, the AM organization had placed a priority on providing STEM-related experiences for girls, and the individuals involved in DOW had an interest in personally offering STEM-related activities. AM staff reported, however, lacking the background and confidence needed to research and develop activities on their own. Participating in DOW provided clear instructions for specific activities, the opportunity to observe skilled facilitators implementing those activities, and some hands-on experience doing the activities themselves.

*I'm definitely not an expert in the STEM field, so that was not an area where I would say, "Oh, I'm going to do a STEM activity" or just Google stuff. Because at the end of the day, I wasn't exposed to it enough to feel confident to deliver the activity. So, when I was exposed to it through the DOW project, we were personally able to hands-on, do the activities. I felt more confident to bring those activities to our program.*

*Understanding the activities presented to the girls ahead of time was a big plus for [feeling more comfortable] because I could answer their questions. [Also] understanding more in-depth vocabulary and agenda flow for engineering activities.*

*Being able to have the resources available with all the materials that we needed and all the information, it was super-easy to bring...when we wanted to bring the STEM topic to*



*the other sessions, it was so easy for us. Instead of going back and doing the research about it, trying to get information or activities. We already had all this, and we knew that the girls loved it, so we could pass it down to the other sessions.*

AM staff members particularly appreciated the clear instructions provided for each activity and the ability to contact OMSI staff with questions. In addition, the modeling provided through the embedded PD model gave AM staff the opportunity to see the activities in action and to learn how experienced facilitators implemented them. This was important because the AM staff had limited background in STEM and informal learning. Observing OMSI staff in action during DOW sessions provided a foundation for AM staff to begin using informal learning strategies to lead STEM activities.

*The agendas helped me out a lot. Having contact with [OMSI staff member] when I needed more information in regards to the activity or the materials needed[...] she would send me her agenda that had the specific materials, the description of the activity, and how to facilitate it. So the instructions were really clear in regards to that. Her agendas were clear in regards to what is the purpose of the activity, the materials, the procedures to follow in order to do the activity. [...] Before implementing them in other sessions, I would pretty much see the whole activity done in the Echo Shaw session.*

Overall, AM staff members reported that DOW had an appreciable impact on their organization and on the girls participating in the after-school program. Staff members now have deeper and broader understanding of STEM-related programming and are better able to offer STEM experiences to the girls participating in DOW as well as to other girls throughout the after-school program.

*It has definitely allowed us to bring a broader set of STEM-related ideas. Before it was basic things, like "let's build a tower with cups." With DOW we have been able to expose all of our groups to more STEM-related activities. With Adelante Mujeres, it has definitely allowed us to do that. And that's something we weren't doing before.*

**Results:  
General Public**



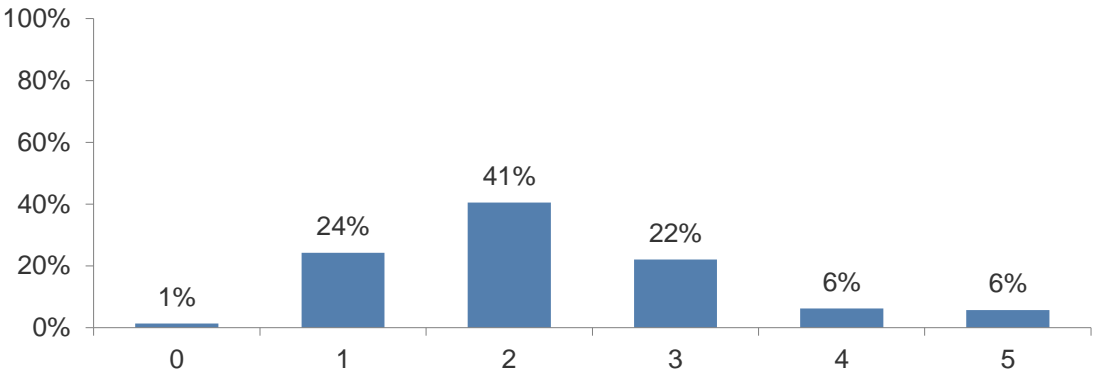
## Results: General Public

### Engagement

Although this evaluation focused primarily on the DOW programming and PD delivered in Year 4, we also gathered exit survey data to examine visitors’ experience with the DOW exhibition at OMSI.

The evaluation first sought to determine visitors’ level of engagement with the DOW exhibition. Visitors were presented with images of the five types of components included in the exhibition (water tables, shake tables, wind components, bridge, and text panels) and asked to indicate which they had used. The data indicate that engagement with the exhibition was strong, with nearly all respondents (99%) reporting that they used at least one type of component (See Figure 38). About two-thirds of respondents (65%) reported using one or two components, while the remaining third (34%) reported using three or more components.

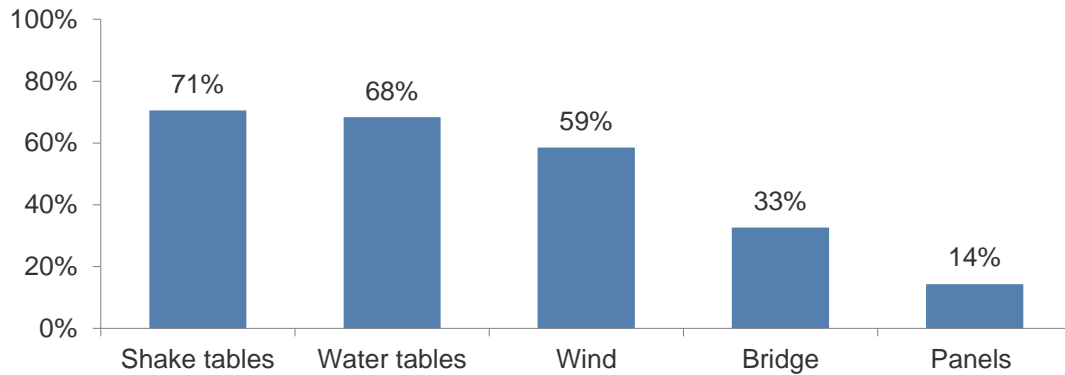
**Figure 38. Number of components used**



N = 227

Respondents also reported engaging with a range of exhibit components. More than two-thirds reported using the shake tables (71%) and water tables (68%) and nearly two-thirds reported using the wind components (59%) (See Figure 39). About a third of respondents used the bridge (33%), while a smaller number of respondents (14%) reported engaging with the informational panels about engineers.

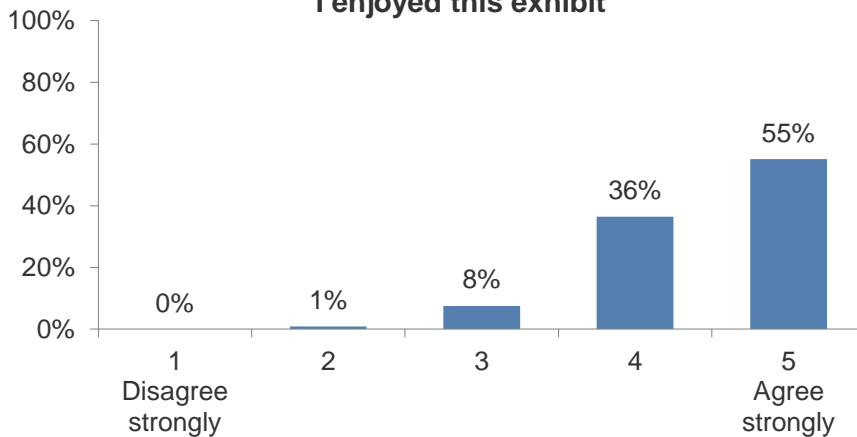
**Figure 39. Components Used**



N = 224

The evaluation also sought to determine the extent to which visitors enjoyed the DOW exhibition. The vast majority of respondents (91%) rated their agreement with the statement “I enjoyed this exhibit” as a “4” or “5” on a 1–5 scale where 1 meant “Disagree strongly” and 5 meant “Agree strongly” (See Figure 40).

**Figure 40. Responses to: "I enjoyed this exhibit"**



N = 225

When asked to identify what they most enjoyed about the exhibition, respondents mentioned a range of exhibition features. More than a third of responses (35%) identified one or more exhibition activities or components, such as the wind component, water tables, shake tables, or airplanes (See Table 6). A quarter of responses (25%) described characteristics of the

exhibition, including the hands-on aspect of the exhibition, the opportunity for personal interaction, and the challenges the exhibition presented. Other common responses included that the exhibition was child-friendly or child-focused (16%) and that respondents enjoyed engaging in the design process (12%) such as building or making things, designing and testing designs, and experimenting. Other responses discussed the topics presented in the exhibition (4%), such as science, engineering, and aerodynamics, and that the exhibition related to the respondent’s prior interest in the topic (1%).

**Table 6. Responses to "What I enjoyed most about the exhibition was..."**

| Response Category                                  | % of Responses (N=586) |
|----------------------------------------------------|------------------------|
| Exhibition activities or components                | 35%                    |
| Characteristics of exhibition                      | 25%                    |
| Child friendly/focused                             | 16%                    |
| Engaging in design processes                       | 12%                    |
| Overall exhibition design                          | 5%                     |
| Topics presented in exhibition                     | 4%                     |
| Exhibition related to respondent's prior interests | 1%                     |
| Other                                              | 2%                     |

Sample comments are provided below. Many comments touched on multiple themes and, therefore, were included in more than one category.

*It's very interactive and creative. [My daughter] liked the ability to create her own and she had the freedom to do it.*

*Getting all wet. It was awesome. [We] connected the hoses just right to the funnel and made the propeller spin.*

*Being able to build and test structural integrity and watching other kids play.*

*The airplanes and how we used mechanisms to see if they would go further or higher.*

*They have multiple activities and more than one seat at each station, so more than one kid can play.*

*That it helps kids think about working things out on their own.*

*That it's hands-on and play-based and that it didn't get too crowded today.*

*Being able to test theories hands-on, which is better than someone telling you about it.*

*Watching the children as they play, you could see the wheels turning as they figured it out, especially at [the] rainy city [component].*

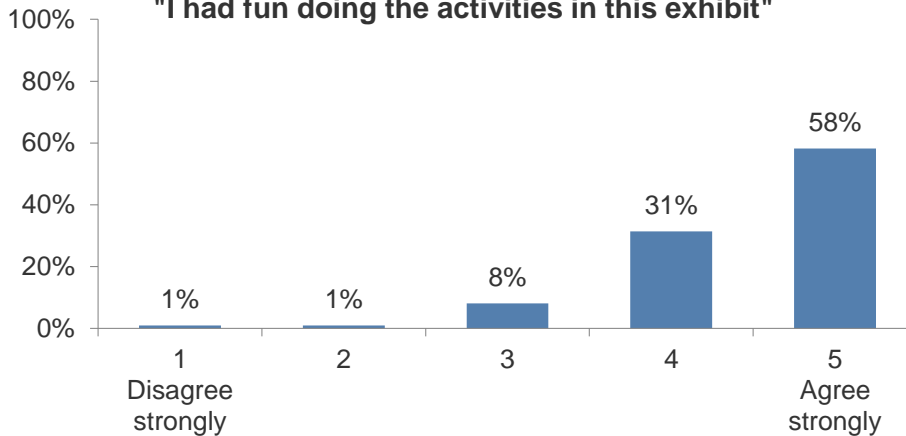
*The variety of items for kids to interact with: building bridges, the water, being able to see what a sailboat does, and what simulates flying.*

*All the green-friendly education and info that is suitable for kids.*

*Watching the boys being creative and [that] the parents can participate.*

Respondents reported that they had fun while visiting the exhibition. The vast majority of respondents (89%) rated their agreement with the statement “I had fun doing the activities in this exhibit” as a “4” or “5” on a 1–5 scale where 1 meant “Disagree strongly” and 5 meant “Agree strongly” (See Figure 41).

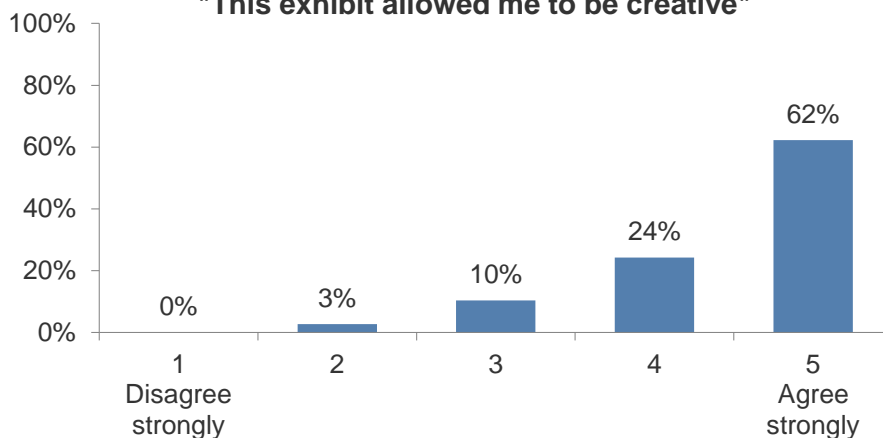
**Figure 41. Responses to:  
"I had fun doing the activities in this exhibit"**



N = 223

Visitors also reported that the exhibit allowed them to be creative. A strong majority of respondents (86%) rated their agreement with the statement “This exhibit allowed me to be creative” as a “4” or “5” on a 1–5 scale where 1 meant “Disagree strongly” and 5 meant “Agree strongly” (See Figure 42).

**Figure 42. Responses to:  
"This exhibit allowed me to be creative"**



N = 223

## Knowledge

To explore visitors’ understanding of the exhibition, we asked respondents how they would describe the exhibit to someone else. Responses encompassed many different domains, with few responses (10%) specifically using the words “engineering” or “engineer,” although some

responses conveyed concepts related to engineering activities and domains without using those words (See Table 7). Many responses (14%) indicated that the respondent would describe the exhibit as being about the environment or natural world, including events like earthquakes, natural disasters, water, air, and other natural phenomena. Others (11%) indicated that the exhibition was about science, saying that it related to physics, scientific discovery, or science in general. Some responses did identify the topic as engineering (10%), with several emphasizing that the exhibition provided a basic or accessible introduction to engineering for children. Still others identified the exhibit as being about building or construction (10%) or urban planning or public works (9%) including city planning, infrastructure, bridges, or transportation. Other responses (7%) discussed the design process, including problem-solving, being creative, experimenting, and testing. Many of these comments reflected the conceptualization of engineering that DOW sought to promote.

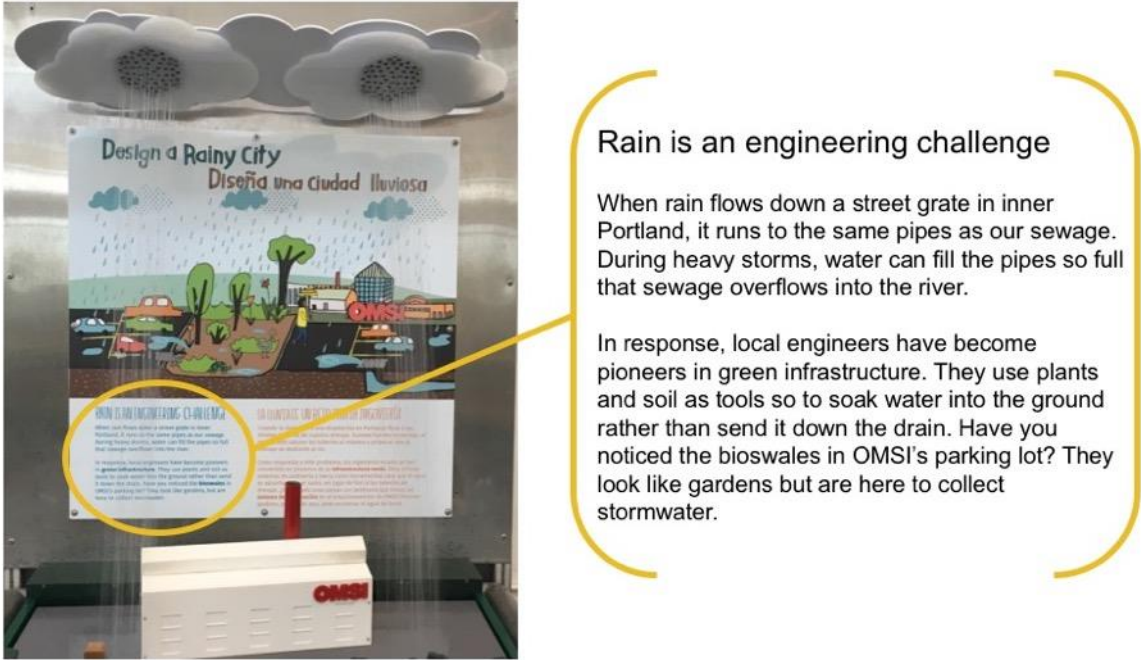
**Table 7. Responses to "If you were going to tell someone at home what this exhibit was about, what would you tell them?"**

| Response Category                            | % of Responses (N=631) |
|----------------------------------------------|------------------------|
| Environment/natural world                    | 14%                    |
| Science                                      | 11%                    |
| Engineering                                  | 10%                    |
| Building/construction                        | 10%                    |
| Hands-on/experiential                        | 10%                    |
| Urban planning/public works                  | 9%                     |
| Describe exhibition elements/characteristics | 9%                     |
| General positives                            | 7%                     |
| Engaging in design processes                 | 7%                     |
| For children                                 | 6%                     |
| Educational                                  | 5%                     |
| Play                                         | 2%                     |



In considering these responses, we examined the labels included in the DOW exhibition, including the example presented in Figure 43.

**Figure 43. Design a Rainy City label**



This label conveyed a great deal of useful information about how engineers solve problems related to the management of storm water in Portland. In examining this label, it also becomes clear how visitors may have understood this section as focused on the environment or urban planning rather than (or in addition to) the topic of engineering.

Some respondents, when asked to describe the exhibition, focused on what the exhibit was like rather than what it was about. Some responses explained that the exhibition was hands-on or experiential (10%) or described specific elements or characteristics of the exhibition (9%) such as the bridge, boats, or the exhibition’s interesting or challenging qualities (See Table 7). Other responses emphasized that the exhibition was for children (6%), that it was educational (5%), or that it promoted play (2%). Finally, some responses provided general praise (7%), with most noting that the exhibition was fun.

Below are samples of how respondents said they would describe what the exhibit was about.

#### Environment/natural world

*Hydro-dynamics. Natural resources and storm management.*

*Learning about your environment.*

*The environment and earthquakes and erosion.*

*Hands-on about the environment.*

*Earthquakes, natural disasters.*

#### Science

*It's lots of physics here. Pulleys, water, construction of different bridges is definitely physics. Kids can get principles from water flowing.*

*Generally speaking, science and physics.*

*Hands-on, interactive, challenging, problem-solving. You are doing scientific discovery and making changes to see if it gives different results.*

*Learning about science and the way the world works with hands-on activities.*

*Experimenting with physics.*

#### Engineering

*It was about mechanical engineering.*

*Lots of fun activities. It makes me interested in engineering. This section is more engineering-related than science.*

*Kids learning about engineering concepts for planning a city [also coded “Urban planning/public works].*

*Learning about engineering.*

*It's about basic hands-on engineering for small children.*

### Building/construction

*Building is what it's about.*

*It's focused on building and helps kids with cognitive functioning and connecting the dots.*

*Being able to build whatever the solution can be, and seeing if you are right are wrong.*

*Building, working with your hands.*

*Building. Tells you about building. I'm in construction. It gives me a chance to show the kids what I do.*

### Urban planning/public works

*It is about city planning. It is interesting to see how difficult city planning is.*

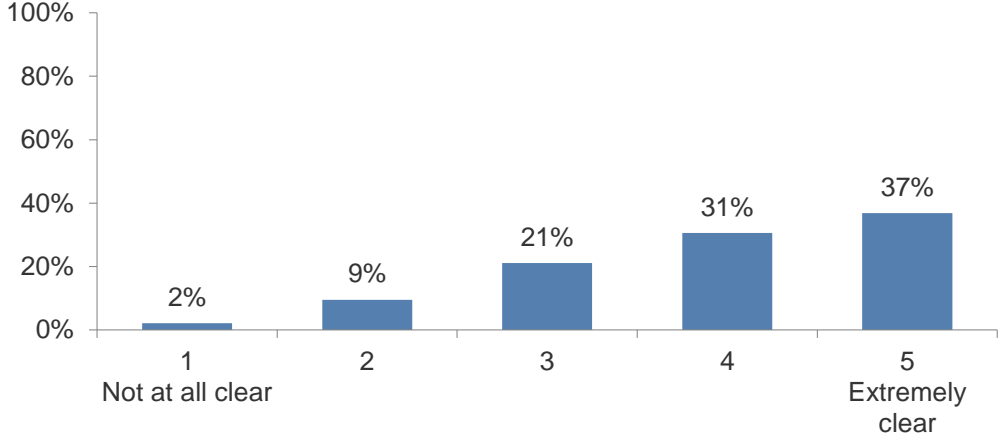
*Different ideas of thinking how cities are designed; future methods of preventing pollution.*

*Bunch of exhibits: transportation, bridges.*

*It's about city infrastructure and working with nature [Also coded “Environment/natural world”].*

As the data were collected, we continually reviewed them to check data quality and identify emerging patterns. As we examined the responses to the question about the topic of the exhibition, we wondered whether visitors understood that it was focused on engineering. To explore this, we added a survey item to assess the clarity of the engineering message and used the revised instrument for the second half of data collection. In this item, respondents were asked to rate how clear it was to them that the exhibit was about engineering. About two thirds (68%) rated the clarity as a “4” or “5” on a 1–5 scale where 1 meant “Not at all clear” and 5 meant “Extremely clear” (See Figure 44).

**Figure 44. Clarity of Engineering Theme**



N = 95

Below are sample comments from those who rated the clarity as a “4” or “5” as to why they provided that rating.

*Really obvious. Bridge, buildings, shake tables; there is an obvious engineering challenge in them.*

*Walking in, it wasn't clear it was about engineering, but after reading the signs on the displays it became more clear, so I would give a #1 walking in and a #4 walking out. I'm really glad to see an exhibit on engineering.*

*I have worked with engineers so I know what they do.*

Importantly, some of those who rated the clarity as a “4” or “5” indicated that the engineering theme was clear to them but may not be clear to others, especially children.

*To me, it's fairly clear, but many people wouldn't know. I studied engineering and understand it. The bridge-building, especially, you realize has to go together in a certain way.*

*I am sure it is engineering. Kids might not think that way, though.*

*I figured it out based on the exhibits. A lot of signage discussed engineering. The displays about engineering also helped me. I am not sure whether kids know or not.*

*My husband and I are both engineers. Certain parts spell out engineering, like the boards, but not the hands-on parts. I'm not sure if people who aren't into the engineering field would know. I didn't read the signs, though.*

*Clear for us but not the kids.*

Finally, some respondents who rated the clarity as a “1” or “2” offered comments as to why they provided that rating.

*It's more about science than engineering. Engineers design these things, but kids aren't learning design. They're learning principles of science.*

*Didn't see it until you said it. I see it now.*

*The activities didn't all seem to fit together. The wind activity didn't seem real clear. With the bridges, I kind of get it. Engineering wasn't my first thought.*

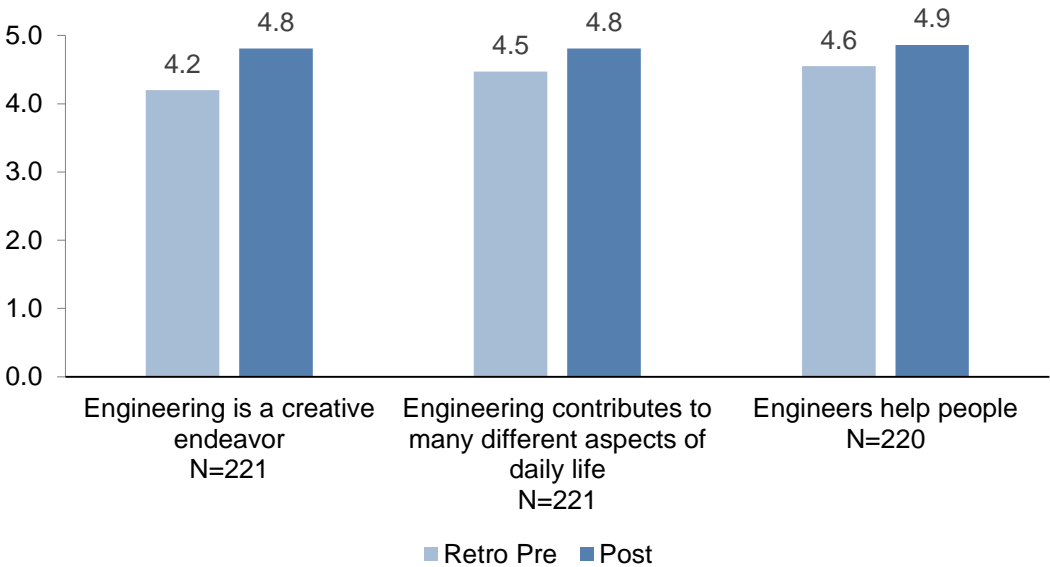
*[The] bridges and crane are engineering. [I] didn't make the connection for water.*

After respondents had shared their understanding of the exhibition in an open-ended way, we used a retrospective post-then-pre design to assess changes in respondents’ knowledge about engineering. Respondents were asked to consider three statements: (1) Engineering is a

creative endeavor; (2) Engineering contributes to many different aspects of daily life; and (3) Engineers help people. Respondents were asked to rate their current agreement with each statement on a 1–5 scale where 1 meant “Disagree strongly” and 5 meant “Agree strongly.” They were then asked to rate their level of agreement with these statements before they had come to OMSI that day.

Levels of agreement in the retrospective pre-exhibit condition were high, with average ratings for each question falling between 4.2 to 4.6 (See Figure 45). This indicates that visitors had a high level of understanding before viewing the exhibit on the day of their visit. Despite this high level of initial agreement, we observed statistically significant increases in levels of agreement when we compared the retrospective pre-exhibit condition with the post-exhibit condition for each item; that is, respondents reported even higher ratings when reflecting on their level of agreement *after* visiting the exhibition.

**Figure 45. Retrospective Pre/Post Agreement**  
(1=Disagree strongly to 5=Agree strongly)



“Engineering is a creative endeavor”  
Retrospective pre-exhibit condition (M=4.2, SD=1.04), Post-exhibit condition (M=4.81, SD=.46)  
 $t(220)=8.80, p=0.00$

“Engineering contributes to many different aspects of daily life”  
Retrospective pre-exhibit condition (M=4.47, SD=.92), Post-exhibit condition (M=4.81, SD=.46)  
 $t(220)= 6.42, p=0.00$

“Engineers help people”  
Retrospective pre-exhibit condition (M=4.6, SD=.807), Post-exhibit condition (M=4.86, SD=.441)  
 $t(219)= 6.58, p=0.00$

As noted on page 16, 62% of respondents had visited the DOW exhibition prior to the day on which they provided their survey responses. This led us to ask whether prior exposure to the exhibit may have contributed to the high levels of understanding shown in the retrospective pre-exhibit condition. To explore this, we compared the ratings of respondents who reported visiting the DOW exhibition previously with those who reported visiting it for the first time, but observed no significant differences in responses when comparing the two groups. We were surprised by this finding, and the reason for it is unclear.

We asked a follow-up question of those respondents who reported rating their agreement with “Engineering contributes to many different aspects of daily life” as a “3” or higher in the post-exhibit condition. Those respondents were asked to provide an example from the exhibit showing how engineering contributes to daily life. About half of the responses (51%) provided an example related to urban planning or public works, including comments regarding transportation, shipping, sewage/plumbing, and bridges (See Table 8). There were also many comments about the contributions of engineering to the safety and maintenance of these elements. Nearly a quarter of responses (22%) discussed the environment or the natural world, commenting on tsunamis, earthquakes, and flooding and how engineering assists in preparing for and responding to these phenomena. Other responses commented on the prevalence of engineering in everyday life such as the waterways in Portland (7%), discussed technology and vehicles that engineers create or improve (6%), or noted that the respondents learned how everyday things such as pulleys, bridges, or cranes work (5%). Additional comments addressed the design process engineers use (4%) or different branches of engineering or science such as civil engineering and physics (2%). Other comments (3%) included a general appreciation for engineers and an awareness of efficiency and innovation.

**Table 8. Responses to, "Give me an example you learned from the exhibit of how engineering contributes to daily life."**

| Response Category                  | % of Responses (N = 380) |
|------------------------------------|--------------------------|
| Urban planning and public works    | 51%                      |
| Environment/natural world          | 22%                      |
| Prevalence in everyday life        | 7%                       |
| Technology and vehicles            | 6%                       |
| How things work                    | 5%                       |
| Design process                     | 4%                       |
| Branches of engineering or science | 2%                       |
| Other                              | 3%                       |

We posed a similar follow-up question to respondents who rated their agreement with “Engineers help people” as a “3” or higher in the post-exhibit condition. Those respondents were asked to provide an example that they learned from the exhibit of how engineers help people. Nearly half of responses (45%) related to urban planning and public works, including comments about engineers' contributions to building bridges, building roads for travel and transporting goods, and managing water in the city (See Table 9). Nearly a quarter (21%) of responses focused on safety, such as engineers creating stable structures that last for a long time and are can withstand natural disasters such as flooding and earthquakes. Other comments focused on the environment and natural phenomena (7%), including responses about engineers’ work to harness wind energy and to respond to tsunamis and earthquakes. Some responses focused on engineers’ work in designing structures and systems within the built environment (6%), contributions to daily life in general (5%), and focus on solving problems (4%). Additional comments related to engineers making things work (4%) and developing technology or harnessing energy (3%). The remaining responses (4%) addressed a wide range of topics including job creation and raising awareness around emergency preparedness.



**Table 9. Responses to, "Give me an example you learned from the exhibit of how engineers help people."**

| Response Category               | % of Responses (N = 347) |
|---------------------------------|--------------------------|
| Urban planning and public works | 45%                      |
| Safety                          | 21%                      |
| Environment/natural world       | 7%                       |
| Designing built environment     | 6%                       |
| General impact on everyday life | 5%                       |
| Solve problems                  | 4%                       |
| Make things work                | 4%                       |
| Technology and energy           | 3%                       |
| Other                           | 4%                       |

### Other Comments

We asked respondents to share feedback about aspects of the exhibition that they did *not* like. More than a quarter of responses (28%) identified broken or missing components or supplies, including the water area being closed on May 28, the bridge component being loose or not working well, that Legos/K'nex were worn out or did not fit together, and that boats were broken (See Table 10).

Another quarter of responses (25%) negatively described conditions of their visit, such as the exhibition being crowded, the behavior of other visitors, and the noise level. Fewer than a quarter of responses (21%) discussed the usability of exhibition components, including a lack of supplies, difficulty with the pegs and connectors on the bridge activity, and water being too deep or a desire to change the speed of the waves. Others noted that they didn't like aspects of the exhibition content (14%), citing that it was geared for older children, was too focused on children in general, or didn't interest the respondent or live up to his/her expectations. Finally, others noted aspects of the exhibit layout (primarily that visitors got wet) (8%) or the quality of the instructions or text provided (4%).

**Table 10. Responses to "What I did not like about this exhibition was..."**

| Response Category                     | % of Responses (N=114) |
|---------------------------------------|------------------------|
| Broken or missing components/supplies | 28%                    |
| Conditions of the visit               | 25%                    |
| Usability of components               | 21%                    |
| Content of exhibit                    | 14%                    |
| Layout of exhibit                     | 8%                     |
| Instructions panels/text              | 4%                     |
| Other                                 | 1%                     |

Finally, we asked respondents if they wanted to share anything else about their experience with the exhibition. Nearly half of responses (43%) provided general praise about the exhibit and about OMSI (See Table 11).

**Table 11. Responses to "Is there anything else that you would like to share about your experience at this exhibit?"**

| Response Category                           | % of Responses (N=102) |
|---------------------------------------------|------------------------|
| General praise                              | 43%                    |
| Good for children                           | 17%                    |
| Suggestions for improvement                 | 16%                    |
| Positive comments about exhibition elements | 10%                    |
| Educational                                 | 5%                     |
| Hands-on                                    | 5%                     |
| Not appropriate for younger children        | 4%                     |
| Appreciated seeing female engineers         | 1%                     |

Below are some sample comments that praised the exhibition and/or OMSI in general.

*It got me inspired and now I'm going to go home and get more books and build things.*

*I really enjoy it. It's one of the exhibits we spend more time in. My son likes to know how things are built and here he can be creative.*

*It was all positive vibes and no bad info.*

*Keep doing what you're doing. Every time we come here, it's something different. It keeps the kids engaged.*

*I can come here 15 times and still not see or know everything.*

Other responses emphasized that their children enjoyed the exhibition or that it was well suited for children (17%).

*It's my kid's favorite exhibit.*

*It's great; [my child] spent a ton of time.*

*It was fun. The kids loved it.*

*It's great that this is available to kids and is so hands-on.*

Some responses (16%) suggested improvements, including providing sections, activities, or furnishings for younger children; reducing the amount of text on the labels; providing a way to wash or sanitize hands; featuring more engineers of color; and providing examples of how engineers interact with society. Other responses (10%) shared positive feedback about exhibition elements including the blocks, crane, water, and the number and variety of stations. Additional comments mentioned that the exhibition was educational and provided opportunities for children's growth and learning (5%) and that it was hands-on and interactive (5%). Some responses noted that the exhibition was not suited to younger children or that their children were

too young to fully participate in the activities (4%), while others (1%) expressed appreciation for the presentation of female engineers.

**Results:  
DOW Educational  
Model**



## Results: DOW Educational Model

The DOW Educational Model sought to engage girls with experiences that illuminate the social, personally relevant, and altruistic nature of engineering by providing programming for girls, experiences for parents and caregivers, and PD for staff members in community-based organizations. Over the four years of the project, the OMSI team aimed to respond to its partners, the audiences it engaged, the broader social context, and its members' own learning. While the DOW vision remained constant, the ways in which the project was implemented evolved over time. The team's aim was to refine and improve the DOW offerings over the project lifecycle, and iterations continued up to the end of the project. For example, in Year 4, the PD provided to AM staff shifted to focus on a combination of the embedded PD model—in which AM staff observed the OMSI team in action—and reflective discussions, rather than workshops.

Another example was in the language used to describe DOW. For most of the project, the OMSI team described DOW as a network. As the evaluation examined the implications of network theory for DOW and shared these insights with OMSI project staff, the DOW team identified that the concept of “community” was more reflective of the DOW model than “network” and shifted the terminology accordingly. The OMSI team members emphasized that they had not previously discussed the meaning of “networks” or “communities” during the project nor reviewed the existing literature base around these models and had used the terms somewhat interchangeably during the project. The meaning and specificity of these terms emerged during reflections on the project as part of the evaluation process; as the Garibay Group team talked with the OMSI team to more fully understand the vision for DOW, the underlying model came more clearly into view.

The evaluation of the DOW Educational Model is based on the following description provided by OMSI staff in summer 2017. It reflects the vision for the program as it had evolved to that point.

*The vision for the DOW model is to empower and promote girls' pursuit of engineering careers by cultivating a community of stakeholders (including OMSI staff, CBO staff, engineering role models, and caregivers) to engage girls with experiences across different contexts (community, museum, home) that illuminate the social, personally relevant, and altruistic nature of engineering.*

The description includes three components: (1) Cultivating a community of stakeholders, (2) Engaging girls with experiences across different contexts, and (3) Illuminating the social, personally relevant, and altruistic nature of engineering. As the third component has been addressed in the preceding sections of this report, the following section focuses on the first two components. Since the current report focuses on Year 4 of the project, this section primarily discusses the implementation of DOW in partnership with AM. A limited discussion of the partnerships with Girls, Inc. and Boys and Girls Club is also included.

### **Component 1: Cultivating a community of stakeholders**

The first component of the DOW Educational Model addresses the goal of cultivating a community of stakeholders centered on the girls involved in DOW; it focuses on engineering activities and careers. To explore the extent to which DOW cultivated this community, we have constructed a series of diagrams which depict the relationships within the community related to engineering. That is, these diagrams serve to illuminate the relationships that empower and promote girls' pursuing of engineering activities and careers rather than relationships that provide support or empowerment in more general ways.

Figure 46 depicts the starting point from which DOW emerged. The girls participating in the Chicas after-school program are pictured at the center of the diagram (blue circle). Individuals and groups that OMSI identified as part of the community to be cultivated (OMSI staff, AM staff, guest engineers, and the girls' parents/caregivers) are depicted in green circles. At the start of the project, AM had an emerging relationship with the girls it served related to engineering, as indicated by the dashed line—that is, AM was beginning to offer STEM-related programming and provide exposure to STEM-related careers for girls in the Chicas program. At that time, no other green circles had relationships with the girls concerning engineering. At the start of the project, however, OMSI had a pre-existing, moderately strong relationship with Adelante Mujeres that focused on engineering or related STEM domains more generally. OMSI had emerging relationships with the guest engineers.

Figure 46. Starting point for community of DOW stakeholders

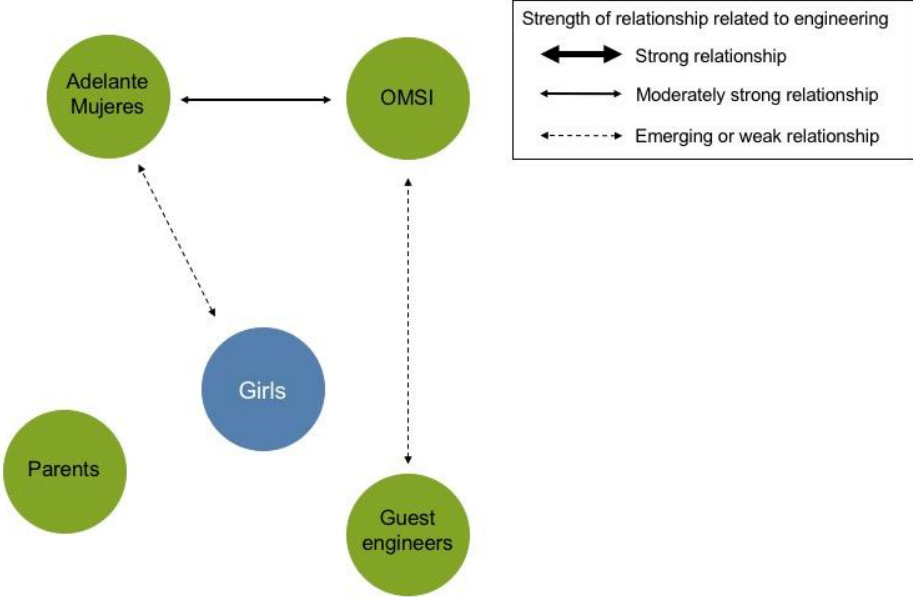
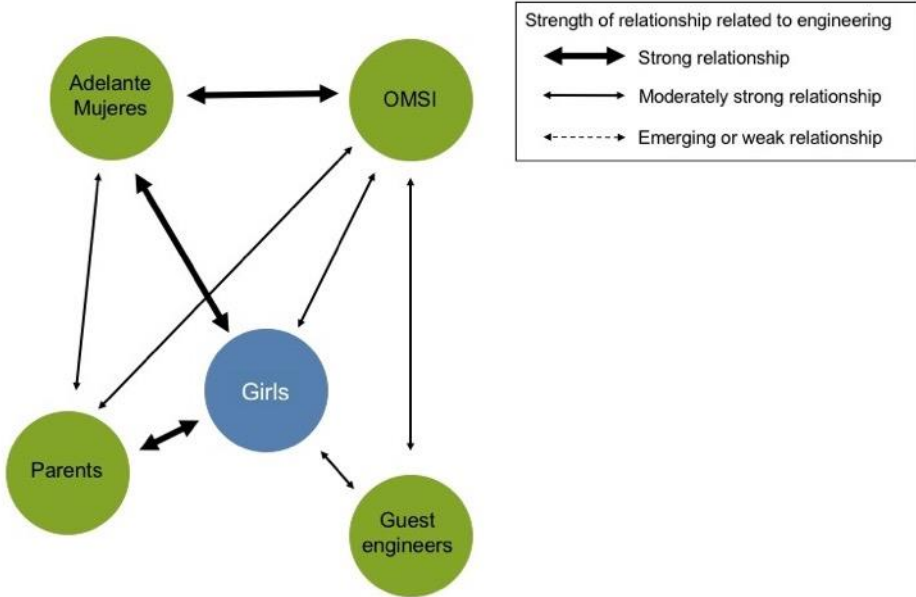


Figure 47 depicts a hypothetical, mature community of DOW stakeholders. In this diagram, all four green circles have relationships with the girls concerning engineering. AM staff and parents/caregivers are depicted with strong relationships and OMSI and the guest engineers have moderately strong relationships. As a result, it is clear that the girls are positioned in the center of a community in which different stakeholders provide encouragement, support, and opportunities related to engineering.



**Figure 47. Hypothetical mature community of DOW stakeholders**



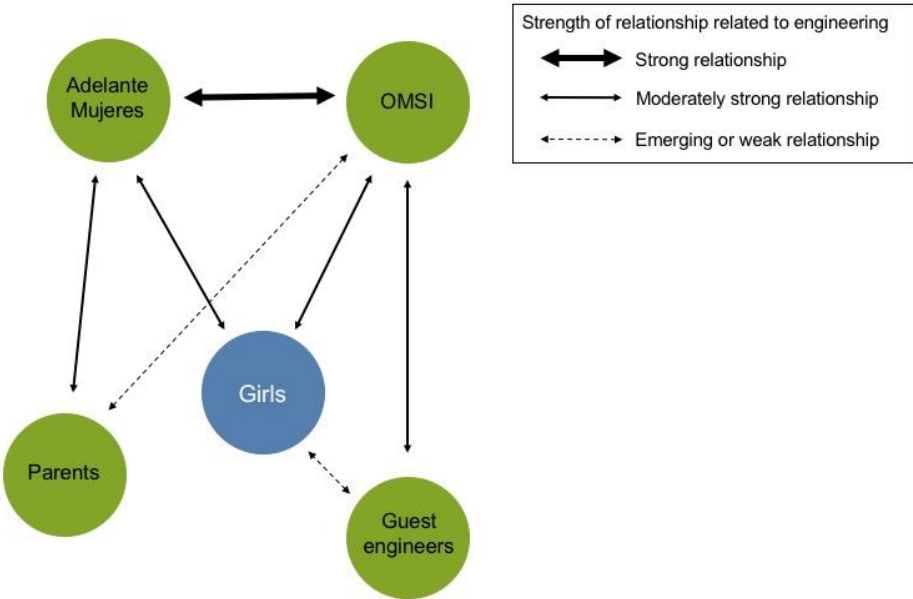
Relationships also exist among the green circles, indicating the ongoing connections required to nurture a community of stakeholders. For example, a moderately strong relationship is depicted between OMSI and parents/caregivers, who are likely to require support in order to provide guidance to their girls. An AM staff member described the importance of OMSI offering educational opportunities for parents and caregivers:

*And at the same time, it was also not only exposing the students but also creating that consciousness among the parents and exposing them to the STEM fields. And sending projects with the girls home so the parents could also learn what the girls were doing in the sessions...Not just delivering workshops for the students but also a lot of teaching for the parents. More than sending activities home and exposing them to the field by their daughters talking to them about it, it was also bringing [parents] to the workshops or to the schools and offering them workshops around the STEM field.*

Clearly, many factors contribute to development of a mature community, including the resources available, partner needs and priorities, and the skills and readiness of particular staff members.

Figure 48 depicts the current status of the DOW stakeholder community based on the evidence obtained in this evaluation. It illustrates the strengthened relationship between AM staff and the girls concerning engineering. This connection has been fostered and cultivated through the DOW program by increasing AM staff members' exposure to, comfort in, and confidence in delivering engineering activities to the girls.

**Figure 48. Current community of DOW stakeholders**



This connection between AM staff and girls is moderately strong; AM staffers are still developing their skills in engaging girls in engineering activities. The data indicate that staff did gain awareness and confidence related to the DOW activities specifically. AM staff did not appear, however, to gain general strategies around informal science and engineering education. In addition, the data indicate that AM staff are actively and enthusiastically incorporating small-scale, ice-breaker, or brain-teaser activities with the girls in the Chicas program. There is also evidence that staff intend to implement one or two of the larger-scale, more complex engineering activities that OMSI staff implemented during DOW. It is possible that AM staff may have developed stronger skills had they engaged in formal professional development activities in addition to the embedded PD and the three reflective discussions.

The diagram also illustrates strengthened relationships between the guest engineers and OMSI and an emerging relationship between the guest engineers and the girls, one that developed during the DOW sessions. To explore the role of the guest engineers within the DOW community, we asked guest engineers for their perspectives on what their participation might bring to the girls in the DOW program. They reported their hopes to build awareness of engineering, serve as role models, and inspire excitement and confidence.

*I envisioned that my participation would increase awareness of [the respondent's field], provide another example of what a career in engineering could look like, and prove another positive example of a woman in a STEM field.*

*I hope to get the girls excited about science and engineering. I have degrees in [respondent's fields]....I hope[d] I could show them that they can be whatever they want.*

Next, we asked the guest engineers about the girls' responses to their visits. Both engineers provided positive feedback, noting that girls were engaged and interested during their visits and asked good questions. One engineer noted that some returning girls remembered her and her research from her previous year's visit, which she felt demonstrated that she'd had an impact.

*I had a really good time with the girls. They had a lot of good questions for me...*

*The girls were high-energy, with different levels of engagement during the first half of the session, when I talked about what I do for a living and answered their questions. The vast majority of the girls were at least somewhat engaged, with the majority very engaged (listening, answering questions, asking questions, participating in discussion).*

We also asked the guest engineers about the extent to which they felt they were part of a network of stakeholders supporting girls in the context of DOW (OMSI was using the term 'network' at that time rather than 'community'). While neither engineer reported feeling part of a network or community around DOW, one guest engineer did express the importance of female role models.

*I don't feel that I am connected to this network. I worked only briefly with OMSI staff in DOW context, and don't know any of the other stakeholders.*

*More and more I miss having a female role model in my own field, and I am more aware of the importance a role model can have.*

One guest engineer shared that she wanted to be more involved in the DOW community, indicating that there may be opportunities to deepen the involvement of local female engineers in supporting girls and possibly other stakeholders, such as parents/caregivers or CBO staff.

*I would have liked to participate more in this program, but was often not given the opportunity. Although I was involved with the initial activity creation, I was never included in later activity creation meetings beyond the first. Later, I was not included on critical emails regarding the time and date of the capstone event, and therefore could not participate.*

Importantly, Figure 48 illustrates that parents and caregivers are not yet engaged in the community as it relates to supporting their girls in learning about engineering. It is clear from the data that parents and caregivers are highly engaged in supporting their girls' education and professional aims in general. The evaluation, however, yielded no evidence that parents and caregivers are engaged as stakeholders specifically in empowering and promoting girls' pursuit of engineering activities or careers. One AM staff member emphasized the importance of engaging parents and caregivers and the ways that DOW had intended for parents to become engaged in the DOW community.

*As we all know, working with Latino families...we say it in our program, if we want students to be successful we must bring the entire family on board. So, with the DOW project, that was a crucial component of it. We wanted to make sure that the families were aware of what the girls were doing and that they were also learning with their daughters about STEM fields. That was a really important part of this project. Although maybe not all parents took as much as we wanted them to, I know that all the parents at least heard about it through the project that their daughters took home. And then we had those parents who were able to come to the workshops and do hands-on activities and were able to visit OMSI.*

This AM staff member reported that parents and caregivers were exposed to DOW through a take-home activity. OMSI staff, however, provided an update stating that the activity was not implemented as planned and instead was handed out and explained by the AM staff at a later time. The evaluation data revealed that the activity was not completed at home and parents and caregivers did not engage in it with their girls.

Figure 48 also illustrates that the current relationship between OMSI and AM is even stronger than it had been at the beginning of the project. The evaluation has revealed two factors that have contributed to strengthening this partnership. First, both organizations capitalized on an overlap in their respective needs and goals in developing DOW. AM staff members explained that their organization had identified STEM as a priority for the Chicas program years ago:

*You know, I think OMSI came in at the perfect time, that our organization was starting to evolve into more of the STEM-related fields. [When representatives from the two organizations had their first meeting], we talked to them about wanting to do more STEM-related activities and with that, wanting to do a STEM camp. We started building that relationship with OMSI way back then, knowing that later on we wanted to build something bigger. So it was crucial that we had a solid relationship between OMSI, Adelante Mujeres and Chicas, as well as a solid relationship with the students and the families. OMSI definitely came in at a perfect time to build that relationship with Mujeres. To be active members, partners with the organization. They really came in to start that STEM component that we needed for the program.*

The partnership developed between OMSI and Girls, Inc. through DOW in Year 3 provides a contrast where the partnership did not prove to be especially strong. In that case, staff members who were interviewed noted that Girls, Inc. already had a robust national STEM initiative in place and was not in search of additional engineering programming. Girls, Inc. staff also noted that they had experience in STEM and in engaging girls (Garibay Group, 2016).

A second factor evident in the data is that OMSI actively and consistently sought feedback from AM staff members then acted on that feedback to develop and later revise girls' programming.

*At the beginning of this project, OMSI took our staff to OMSI for one day of training and also brainstorming of what the project would look like, what activities they were going to*

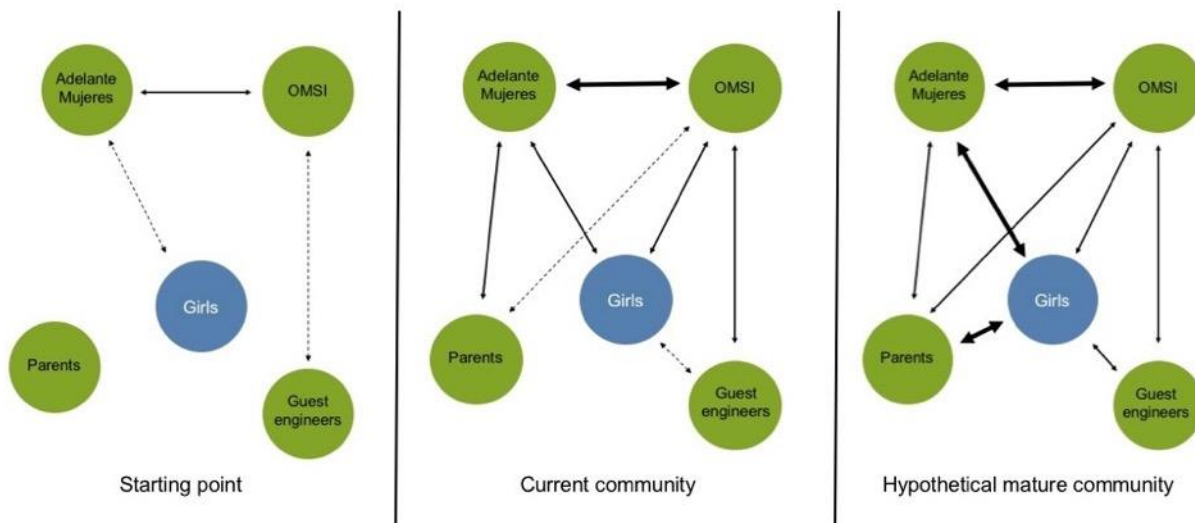
*do with the girls, how they were going to take the parents there, and what exhibits did we want them to participate in. During that day of training and brainstorming, we were taken to one of their big warehouses where they start building all of those exhibits. At those warehouses, they had all these activities that they wanted the staff to try out. And then once we tried it, we would provide feedback. Whether “hey, it’s gonna work for the girls” or “maybe we should add this component to it.” And so they really wanted our feedback on how they could make that appealing to our Latino families.*

*And they also listened to our feedback. They were very respectful...when we had any feedback for them, they took our feedback very well and then the next time we noticed that they did take our feedback because things have changed or they had improved.*

This commitment to requesting and acting on feedback not only demonstrated respect for AM as a partner in DOW but also ensured that the programming was highly appropriate and relevant to the girls AM served.

To summarize this component of the model, we provide a diagram depicting the progression of community development we have discussed. The starting point for DOW is shown at the left, the current DOW community in the middle, and the hypothetical “mature” community at the right (See Figure 49). This diagram illustrates the progress OMSI has made in cultivating the DOW community and offers a vision of the future.

**Figure 49. Starting point, current, and hypothetical mature community of DOW stakeholders**



**Component 2: Engaging girls with experiences across different contexts**

The second component of the DOW Educational Model aims to engage girls with engineering experiences across different contexts, including community, OSMI, and home environments. This evaluation found evidence that DOW engaged girls with varying levels of intensity across two of the contexts: community and museum. Experiences in the community context were delivered through the five sessions delivered at AM and a field trip to Nike. As detailed above, DOW delivered a robust engineering experience at AM that effectively engaged girls with engineering activities. The field trip to Nike was a single short-duration experience that girls reported as a highlight of their involvement with DOW. A family trip to OMSI served as a one-time short-duration experience in the museum context well received by both girls and caregivers.

The vision for DOW also included engaging girls with engineering activities at home. The OMSI team hoped identified a take-home activity as a method to engage girls and parents/caregivers together in the home environment. OMSI staff developed an activity for this purpose, which unfortunately was not implemented as planned. The AM staff only handed out and explained the activity at a later date.

The evaluation has found no evidence to indicate that girls engaged with engineering activities or conversations at home. Data from the girls' focus groups indicated that very few participants completed the take-home activity. Two participants in a parent/caregiver focus group reported their girl bringing the activity home but did not participate in its completion. One participant did indicate their daughter did the activity with her brother. Overall, however, no evidence existed of other engagement through sustained conversation or follow-up investigation.

The data suggest that the DOW Educational Model had varying degrees of success in different CBO contexts (Garibay Group, 2016). For example, DOW has been seen to work most effectively in after-school programs with consistent attendance and less so in drop-in settings. (For example, the relatively loose structure at Boys and Girls Club (BGC) meant all youth did not consistently attend DOW activities.) In addition, longer sessions appear more suited to DOW programming than shorter sessions, since sufficient time is needed for iteration and experimentation. These examples show how the CBO context contributes to and changes the implementation of DOW. As such, community context—rather than just being a location or setting of program activities—appears to be essential ingredient of the program.



# Conclusions



## Conclusions

DOW was a dynamic, evolving project that had ambitious aims for building a community of stakeholders to promote girls' pursuit of engineering careers. The team refined its implementation until the very end—most notably around the PD component—to remain responsive to the needs of AM, the girls and parents/caregivers served by AM, the broader community and political context, and the OMSI team's own learning.

While this evolution had positive ramifications from a programmatic perspective, the changing nature of the project proved a challenge for the evaluation to capture outcome data since elements were not held constant over time. (Recall that Years 1 and 2 were slated for front-end and formative evaluation while Years 3 and 4 were planned as summative.) As a result, the following conclusions largely reflect the work of DOW in Year 4, although we were able to draw some conclusions from data collected in prior years. In the future, it would be useful for the OMSI team to identify the point at which sufficient interaction and maturity have taken place in order to hold a project such as DOW constant and then examine its effects.

### *Girls*

This evaluation found that DOW had its strongest outcomes in engaging of girls in engineering activities in Year 4. Attendance at DOW sessions was strong and respondents reported relatively high levels of enjoyment. The field trip to Nike was a particularly enjoyable aspect of DOW this year. Girls, especially new girls, seemed to have also enjoyed the hands-on activities and found them to be memorable. The hands-on activities engaged girls in solving real-world problems, positioning participants as actors in helping others and making the world better.

There is also evidence (albeit indirect) that girls demonstrated persistence during DOW activities, particularly given the time constraints of the program sessions. The data indicate that girls were aware of the purpose of iteration, the process of trying and testing new designs, and what strategies to use in the face of failure. Further, the overall message of empowerment seemed to stay with the girls. They understood that they could do engineering activities and solve problems, that solutions didn't have to be right the first time, and that strategies were available to them when they got stuck.

While we found positive outcomes around engagement, girls' interest in continuing with engineering activities was moderate. It suggests that participation in the program may not have necessarily sparked strong interest in engineering or in continuing to pursue the types of activities introduced in the program. As AM staff members pointed out, however, engagement with DOW nonetheless remained high.

Although small sample size limited our conclusions about learning over the course of the program, the quantitative data suggest small increases in knowledge that engineers help and solve problems. Data from open-ended survey items more clearly indicate that many girls, by the end of the program, could more clearly describe engineering and provide more examples (and more *specific* examples) of what engineers do.

Due to sample size, the conclusions that we can draw comparing new and returning participants are limited. The data do seem to suggest that returning girls entered with greater knowledge that engineers help people. This finding is consistent with the Year 3 evaluation results. The important implication is that girls who went through the program last year gained and *retained* this information. A second implication, however, is that when girls participate for a second year, they are revisiting content around altruism that they had already mastered, indicating a missed opportunity for expanding their learning. The data may also indicate that returning girls entered with greater knowledge that engineers solve problems; this has implications about further opportunities for returning girls to deepen their learning.

Finally, data suggest that DOW had limited impact on the importance that girls place on engineering in general and, on the value of engineering in their lives more specifically. Survey respondents rated the level of importance of engineering as moderate, with no changes observed between the pre- and post-program survey data. Participants' responses about the importance of engineering were lukewarm, although most did note that engineers helped develop many of the products they use (e.g. cell phones). Data from both samples indicated that girls associated engineering with tangible objects that were useful in their lives.

### ***Parents/Caregivers***

Although data indicate that the number of parents/caregivers engaged with DOW was limited, the number did increase compared to Year 3. Those parents/caregivers who participated in workshops enjoyed them, and the vast majority of workshop participants surveyed reported

having learned something. The data indicate, however, that DOW did not build strong awareness among parents/caregivers concerning engineering or gender equity in engineering. Few individuals in surveys or focus groups described specific things they learned. Additionally, while caregivers talked generally about supporting their daughters by encouraging their pursuits and interests, few articulated specific strategies for supporting their girls in science or in pursuing engineering/engineering-related activities. This suggests that workshops may not be the optimal strategy to help equip parents and caregivers with the knowledge required to support their girls in pursuing engineering. (This finding is also consistent with Year 3 evaluation results.)

Parents and caregivers who attended FEN reported high levels of enjoyment. Those adults in focus groups were enthusiastic about their visits to OMSI and saw them as positive learning experiences for their daughters.

Given that parents/caregivers engaged in Adelante Mujeres services are heavily involved in their daughters' lives and education, it seems worth the continued effort to identify approaches that might reach more of them and engage parents/caregivers at a deeper level.

Since the emphasis is on building a community of stakeholders to support girls, engaging parents and caregivers seems critical to the success of a project such as DOW. Going forward, OMSI is encouraged to explore models beyond workshops for parent/caregiver participation and to create a structure for engagement at home beyond a single take-home activity.

### ***Adelante Mujeres Staff***

The evaluation found that DOW provided AM staff with clear examples of engineering activities for the girls they serve and demonstrated the process of delivering high-quality engineering activities in the after-school setting. AM staff members involved in DOW reported becoming more comfortable and confident in offering engineering activities and, in fact, had already taken significant steps to incorporate DOW activities into the Chicas after-school and summer camp programs. Data indicate that staff members found the activities highly engaging for girls and motivated them to implement activities that served more than 500 students. Staff members reported that the clear instructions, opportunity to observe OMSI staff leading activities, and hands-on experience with the activities improved their abilities to implement the activities independently.

AM staff also reported gaining awareness of gender inequity in engineering and learning strategies for engaging girls in engineering. The evaluation did reveal specific knowledge gained about gender inequity in engineering among AM staff members; it is unclear, however, whether staff members gained any strategies to engage girls in engineering beyond the ability to implement the specific DOW activities. It is also unclear to what extent AM staff members could identify the field of engineering and distinguish it from the broader context of the “STEM field.” It seems that the PD approach used in Year 4 lacked sufficient focus or depth to build the skills and knowledge CBO staff would need to independently offer robust engineering activities to the girls they serve. To strengthen the PD model, OMSI staff could consider linking the reflective discussions more clearly to PD aims and to the existing work on reflective practice for professionals working within informal STEM learning. The OMSI team could draw on the existing research that has identified critical factors and the process of reflective practice to implement a more formal, structured process for building skills and knowledge among CBO staff.

### ***General Public***

The evaluation found strong evidence that visitors enjoyed the DOW exhibition, had fun during their visits, and engaged with a range of exhibit elements. On a 1–5 scale where 1 meant “Disagree strongly” and 5 meant “Agree strongly,” the vast majority of respondents rated their agreement with the statement “I enjoyed this exhibit” as a “4” or “5” (91%) and rated their agreement with the statement “I had fun doing the activities in this exhibit” as a “4” or “5” (89%). In addition, 99% of respondents engaged with at least one exhibition component in the exhibit.

The data also indicate that respondents increased their understanding of the nature of engineering. On the retrospective pre- then post-survey items, we observed statistically significant increases in the levels of agreement that engineering is a creative endeavor, that engineering contributes to many different aspects of daily life, and that engineers help people. These gains were observed despite the fact that respondents had already reported high levels of agreement in the retrospective pre-exhibition condition. Respondents gained awareness regarding the contribution of engineering to urban planning and public works as well as its connection to the environment and natural world.

For many respondents, however, it was unclear that the exhibition focused on the topic of engineering. When asked how they would explain the exhibit to others, just 10% of respondents related it to engineering, although some respondents discussed engineering concepts without using the term. When asked directly about the clarity of the engineering message, about two-thirds (68%) rated the clarity as a “4” or “5” on a 1–5 scale where 1 meant “Not at all clear” and 5 meant “Extremely clear,” but a number of those individuals specified that the theme was clear to *them* due to their own knowledge or background but might not be clear to others, especially children.

Overall, respondents gave positive feedback about the exhibition, noting that it was hands-on and interactive, child-focused and child-friendly, fun, and educational.

### ***DOW Educational Model***

Although it is not yet fully realized, DOW Educational Model appears to hold some promise for building community around girls in order to support their engagement with engineering.

The model demonstrated its greatest success in engaging the AM staff as partners in that community. The relationship with AM was well timed, since the organization was seeking to expand STEM offerings, and grew from a pre-existing relationship that provided a foundation for successful collaboration. The partnership was also grounded in OMSI’s demonstrated commitment to seek and act on feedback from AM staff.

The evaluation also revealed that selection of CBO partners was a key factor in the success of projects like DOW; the CBO and its context are critical to a program, not just as settings in which to deliver programming. OMSI will be best served by choosing a CBO interested in expanding STEM offerings and providing staff with robust PD including specific skills and knowledge.

The embedded PD model—in which AM staff observed OMSI staff delivering sessions—was a helpful component since AM staff members had limited STEM background or experience with informal learning strategies. It appears, however, that additional elements are needed to build CBO staff’s skills and knowledge. It seems likely that the Reflecting on Practice work spearheaded by the Lawrence Hall of Science and the PD literature beyond the informal learning sector could both offer tested models for delivering successful PD and identify

evidence-based characteristics of successful PD models. Additionally, it appears that this type of project also requires planning for sustaining the community if and when OMSI moves to another CBO. Ideally, the PD would engage a critical mass of staff members and/or establish a structure for dissemination through the organization.

The field trip to Nike and the involvement of the guest engineers provide examples of how community stakeholders have been successfully involved in supporting girls. Efforts to expand and deepen such involvement could further develop the community of stakeholders and provide more meaningful experiences for girls.

Although parents/caregivers in the AM community are highly engaged and supportive of their girls, they have not been drawn into the DOW community of stakeholders. OMSI might be well-served to consult the literature around migrant education, Head Start, and/or engaging the parents of English Language Learners in K-12 schooling in order to identify strategies adaptable to informal learning. For example, some programs in these domains have reported success when using home visits rather than outside events.

Among DOW's strengths are its focus on a conceptualization of engineering well-grounded in research on engaging girls (for example, Fadigan & Hammrich, 2004; Jenkins & Pell, 2006; NAE, 2008; Weisgram & Bigler, 2006) and the OMSI team's unwavering focus on bringing that vision of engineering into all aspects of the project. OMSI may wish to use a similar approach to conceptualizing the model, perhaps looking to the literature to identify how to build such a community and what key features are associated with its success. The OMSI team, for example, had talked about DOW as a "network" for the first years of the project. When we worked with them and brought in network theory and discussed its implications for the evaluation, however, the team realized that a network wasn't the best reflection of the model. A similar look at the literature around "community" might reveal that this term has specific meanings and particular features that may or may not reflect the DOW model. Understanding the theoretical foundations and evidence base associated with a "community" model could help the OMSI team identify and draw on a theoretical perspective to inform and clarify its vision. This theoretical grounding could provide strength and rigor to the DOW Educational Model, just as the theoretical grounding has structured and supported the vision of engineering that DOW promotes.



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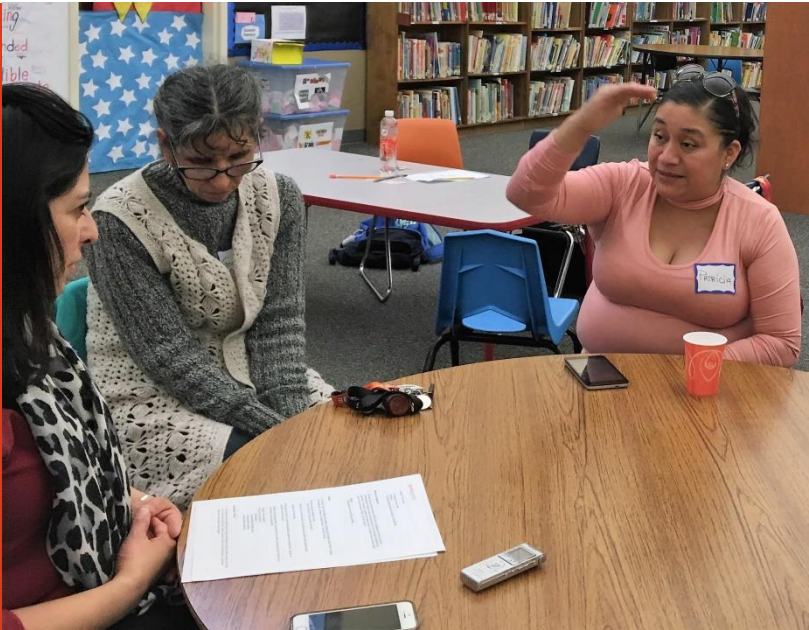




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# Appendices



## Appendices

### Appendix A: Description of Girls' Activities

Designing Our World  
Activity Descriptions for Adelante Mujeres 2016-2017

| Date     | Session #     | Activity                                                                                                                                                                                                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Photos                                          |
|----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| 01/26/17 | 1             | Save The Day Card Game                                                                                                                                                                                        | <p>We used cards to choose an object, a user, and a disaster, then design and build a solution. Examples include a chair for an elephant to use in a flood, or a communication device for a classroom during an earthquake.</p> <p>Usamos tarjetas para escoger un objeto, un sujeto y un desastre para luego hacer un diseño y construir una solución. Algunos ejemplos incluyeron: una silla que un elefante puede usar durante una inundación, o un aparato para que un salón de clases se comunique durante un terremoto.</p>                                                                                                                           | No- could show pic of the cards and/or placemat |
| 02/02/17 | 2             | Base Isolation Interview Adelante Mujeres Engineer                                                                                                                                                            | <p>First, we spoke with an engineer who is part of Adelante Mujeres.</p> <p>Then, we tried out different materials to put underneath a building in order to keep it from falling during an earthquake. Some examples of the materials they tried were tennis balls, bouncy balls, beads, and cotton balls.</p> <p>Primero hablamos con una ingeniera que es parte de Adelante Mujeres.</p> <p>Luego probamos diferentes materiales y los colocamos debajo de un edificio/estructura para evitar que se cayeran durante un terremoto. Algunos ejemplos de materiales que probaron: pelotas de tenis, pelotas saltarinas, cuenticas y bolitas de algodón.</p> | Yes                                             |
| 02/16/17 | 3- Field Trip | <p>Field Trip to OMSI</p> <p>These activities available to try:</p> <ul style="list-style-type: none"> <li>-Cool It Down</li> <li>-Base Isolation on shake table</li> <li>-Caroline's dam activity</li> </ul> | <p>We repeated the earthquake activity from the last session, but using a giant doll house on the shake tables at omsi.</p> <p>We interviewed Caroline, an engineer, and she had an activity about dams.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                | yes                                             |

|          |               |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                               |
|----------|---------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
|          |               |                                                                        | <p>Clara did an activity where we used magnets to try and move water down a ramp and cool it off before it reached the river.</p> <p>Repetimos la actividad del terremoto de la última sesión, pero utilizando una casa de muñecas gigante en las "mesas que se sacuden" en OMSI.</p> <p>Entrevistamos a Carolina, una ingeniera y ella hizo una actividad acerca de represas.</p>                                                                                                                                                                                                                     |                               |
| 02/23/17 | 4             | -Interview with Elizabeth<br>-Marine mammals activity (in development) | <p>First we interviewed Elizabeth and learned how she studies whale sounds in the ocean. Then we designed something to carry a marine sensor underwater. The sensor couldn't sink to the bottom or float to the top- it had to hover in the middle of the tank of water.</p> <p>Primero entrevistamos a Elizabeth y aprendimos cómo estudia los sonidos de las ballenas en el océano. Luego diseñamos algo para llevar un sensor marino a las profundidades del mar. El sensor no debía hundirse en hasta el fondo o flotar en la parte superior- tenía que flotar en el medio del tanque de agua.</p> | Yes                           |
| 03/02/17 | 5- Field Trip | -Field Trip to Nike                                                    | <p>We met engineers, toured the factory, and did a design challenge where we created our own air bag for a shoe.</p> <p>Conocimos a ingenieros, visitamos la fábrica Nike e hicimos un desafío de diseño donde creamos nuestro propio airbag para un zapato.</p>                                                                                                                                                                                                                                                                                                                                       | No                            |
| 03/16/17 | 6             | Interview with Caity<br>Wind/wave energy generator                     | <p>We placed pin wheels in different locations on a peg board and held it in front of a fan to see how much energy we could create.</p> <p>Colocamos molinetes en diferentes ubicaciones en una tabla de clavijas y los colocamos delante de un ventilador para ver cuánta energía podíamos crear.</p>                                                                                                                                                                                                                                                                                                 | yes                           |
| 04/07/17 | 7             | Engineer the Perfect Gift                                              | <p>We found a partner, interviewed them about what item they'd like, then designed and build the perfect gift for our friend.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Could show pic of the booklet |



**Appendix B: Parent Workshop Content**  
 January 20 Workshop: Gender Equity in Engineering

**Professional Development Presentation-Workshop**



**Gender Equity**

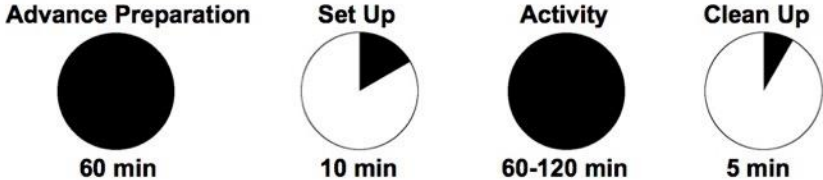
**Goal:**  
 Develop awareness of the gender inequity in engineering and science, and that engineering can be an accessible career option for girls, especially Latinas/minority girls.

**Topics:**  
 Gender equity, inclusion, implicit bias, engineering.

**SITE REQUIREMENTS**

- Projector and screen for showing Powerpoint.
- Tables and chairs for participants.

**TIME REQUIRED**



**INTRODUCTION**

- This form is meant to guide professionals that want to deliver gender equity trainings/workshops to adults/caregivers.
- The content can be adapted to shorten/increase the length of the training, and each facilitator can infuse it with their own style.
- It has been observed that participants are often comfortable working and having discussions in small groups as topics/questions can be personal and emotional for some people.
- It's important to approach the topic with sensibility. Gender equity, and specially, implicit bias, can be topics that trigger different emotions and responses for different people.
- It's important that the facilitator keeps this in mind and adapts the content and length of discussions to serve the needs of each group.

- Notes:**
- Print copies of the PowerPoint presentation for all participants.
  - Suggested script for the facilitator appears in the text in italics. The script is flexible. The facilitator should get familiar with the content and present it in a way that works for them and the group.



## Professional Development Presentation-Workshop

### AGENDA

This agenda is meant to be used as a guide to organize the content of your session. Feel free to adapt it to meet the needs of your session/group. The times listed at the top of each section are approximates. Some discussions can take longer due to the group's background/interests.


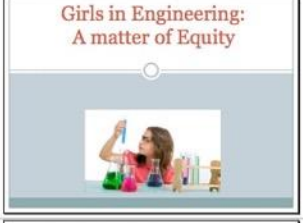
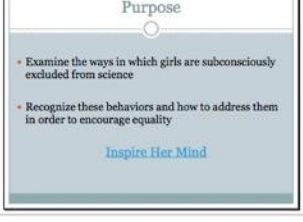
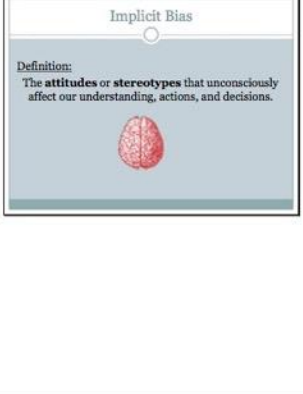
- Welcome group/Housekeeping (location of restrooms, introductions, nametags, etc.)- 10 minutes
- Brainteaser- 15 minutes
- Goal of the session- 1 minute
- Introduction to Implicit Bias concept and discussion- 20 minutes
- Unconscious bias test – 5-30 minutes (read note by slide)
- Gender bias in science- 15 minutes
- Break-10 minutes
- Growth mindset-15 minutes
- Gender bias in the classroom and the museum-20 minutes
- Strategies for engaging girls- 20 minutes
- Closure/Questions-5 minutes

### INSTRUCTOR-LED ACTIVITY

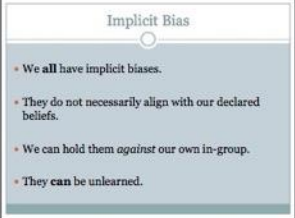
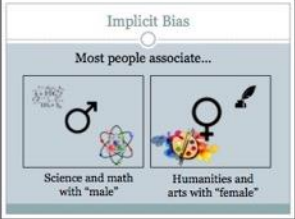


### Slide Show

| Introduction |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1            | <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">Brainteaser Time!</p> <p>A father and his son are in a car accident. The father dies on the spot. The son, badly injured, is taken to the hospital. In the ER, the attending surgeon looks at the boy and says, "I can't operate on this boy. He's my son!"</p> <p style="text-align: center;">Who is the surgeon?</p> </div> <div style="padding-left: 20px;"> <p>(15 minutes)</p> <p>This brain teaser can be done in small groups or individually.</p> <p>Facilitator reads brainteaser out loud and gives participants five minutes to reflect.</p> <p>After five minutes ask groups/individuals to share their responses.</p> <p>Facilitator asks the group what things may condition our responses (surgeons are associated with males; <b>what careers/professions are associated with men? Where do we see these messages?</b>)</p> <p>Note: The answer to the brainteaser is his mom. The mom is the surgeon.</p> <p>If possible, present this slide without alerting participants to the fact that this training covers women in science. Ask participants to refrain from shouting out the answer if they know it or if they've seen it before.</p> </div> |

## Professional Development Presentation-Workshop

|                             |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2                           |    | <p>Facilitator: <i>If you pictured a middle aged white man when you heard the word "Surgeon", you're not alone. These pictures come from the top results of a Google image search of the word.</i></p> <p><i>This brainteaser is a perfect example of unconscious, or implicit, bias. Even though we all know and fully believe women can be great surgeons, when we hear the word, most of us will subconsciously picture a male.</i></p> <p>Question to participants: <b>How can these images impact how girls see science careers?</b></p> |
| 3                           |    | <p>Intro slide</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 4                           |   | <p>(1 minute)</p> <p>Goals/ Purpose of this workshop</p> <p>Facilitator: <i>Today's training will cover the unconscious biases we all have around women in science, and give concrete steps to take in order to address these biases.</i></p>                                                                                                                                                                                                                                                                                                 |
| <p><b>Implicit Bias</b></p> |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 5                           |  | <p>(25 minutes)</p> <p>Facilitator: <i>Who has heard about implicit bias before?</i></p> <p>Participants share thoughts.</p> <p><u>Definition:</u><br/><i>The <b>attitudes</b> or <b>stereotypes</b> that unconsciously affect our understanding, actions, and decisions.</i></p> <p><u>More info:</u><br/><i>These biases, which encompass both favorable and unfavorable assessments, are activated involuntarily and without an individual's awareness or intentional control. Residing deep in the subconscious, these</i></p>            |

## Professional Development Presentation-Workshop

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| 6 |  <p>Implicit Bias</p> <ul style="list-style-type: none"> <li>• We <b>all</b> have implicit biases.</li> <li>• They do not necessarily align with our declared beliefs.</li> <li>• We can hold them <i>against</i> our own in-group.</li> <li>• They <b>can</b> be unlearned.</li> </ul>                                                                                                                                                                           | <p>biases are different from known biases that individuals may choose to conceal for the purposes of social and/or political correctness. Rather, implicit biases are not accessible through introspection.</p> <ul style="list-style-type: none"> <li>• Implicit biases are <b>pervasive</b>. Everyone possesses them, even people with avowed commitments to impartiality such as judges.</li> <li>• Implicit and explicit biases are <b>related but distinct mental constructs</b>. They are not mutually exclusive and may even reinforce each other.</li> <li>• The implicit associations we hold <b>do not necessarily align with our declared beliefs</b> or even reflect stances we would explicitly endorse.</li> <li>• We generally tend to hold implicit biases that <b>favor our own group</b>, though research has shown that we can still hold implicit biases against our own group.</li> <li>• Implicit biases are <b>malleable</b>. Our brains are incredibly complex, and the implicit associations that we have formed can be gradually unlearned through a variety of debiasing techniques.</li> </ul> <p>Source:<br/> <a href="http://kirwaninstitute.osu.edu/research/understanding-implicit-bias/">http://kirwaninstitute.osu.edu/research/understanding-implicit-bias/</a></p> |
| 7 |  <p>Implicit Bias</p> <p>Most people associate...</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Science and math with "male"</p> </div> <div style="text-align: center;">  <p>Humanities and arts with "female"</p> </div> </div> | <p>Facilitator: <i>Most people associate careers in science and mathematics with the male gender, and humanities and arts with the female gender.</i></p> <p>Facilitator: <i>Think about yourself when you were 10 years old. What messages did you hear about careers? About science? About humanities?</i></p> <p>Small group discussion: <b>Where do these messages come from?</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |



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8



(5 minutes-30 minutes, depending if participants are taking the test as part of the training or not.)

Facilitator: *People don't always say what's on their minds. One reason is that they are unwilling. For example, someone might report smoking a pack of cigarettes per day because they are embarrassed to admit that they smoke two. Another reason is that they are unable. A smoker might truly believe that she smokes a pack a day, or might not keep track at all. The difference between being unwilling and unable is the difference between purposely hiding something from someone and unknowingly hiding something from yourself.*

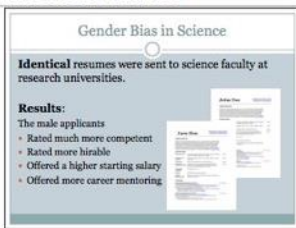
*The Implicit Association Test (IAT) measures attitudes and beliefs that people may be unwilling or unable to report. The IAT may be especially interesting if it shows that you have an implicit attitude that you did not know about. For example, you may believe that women and men should be equally associated with science, but your automatic associations could show that you (like many others) associate men with science more than you associate women with science.*

Source:  
<https://implicit.harvard.edu/implicit/education.html>

Facilitator can encourage participants to take the test during the training or afterwards.

### Gender Bias in Science

9



(15 minutes)

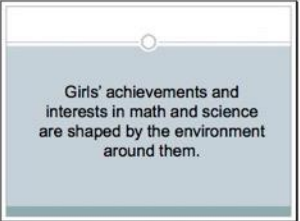

Facilitator: *Corinne Moss-Racusin, a social psychologist at Skidmore College, recently spoke at the Stanford University School of Medicine to describe her research on gender bias among STEM faculty, including an experiment that had scientists evaluate identical resumes of a candidate named either "Jennifer" or "John."*

*In their study, Moss-Racusin and her colleagues created a fictitious resume of an applicant for a lab manager position. Two versions of the resume were produced that varied in only one, very significant, detail: the name at the top. One applicant was named Jennifer and the other John. Moss-Racusin and her colleagues*

## Professional Development Presentation-Workshop

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|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                                                                                                                                                                                                                                                                                                                                      | <p>then asked STEM professors from across the country to assess the resume. Over one hundred biologists, chemists, and physicists at academic institutions agreed to do so. Each scientist was randomly assigned to review either Jennifer or John's resume.</p> <p>The results were surprising—they show that the decision makers did not evaluate the resume purely on its merits. Despite having the exact same qualifications and experience as John, Jennifer was perceived as significantly less competent. As a result, Jennifer experienced a number of disadvantages that would have hindered her career advancement if she were a real applicant. Because they perceived the female candidate as less competent, the scientists in the study were less willing to mentor Jennifer or to hire her as a lab manager. They also recommended paying her a lower salary. Jennifer was offered, on average, \$4,000 per year (13%) less than John.</p> <p>Source: <a href="http://gender.stanford.edu/news/2014/why-does-john-get-stem-job-rather-jennifer">http://gender.stanford.edu/news/2014/why-does-john-get-stem-job-rather-jennifer</a></p> |
| 10 | <div data-bbox="430 955 716 1165" style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Gender Bias in Science</p> <p style="text-align: center;">○</p> <p style="text-align: center;">Women are underrepresented in many science and engineering occupations.</p> <p style="text-align: center;">How does this gap affects society and how problems are solved?</p> </div> | <p>Facilitator: Women remain underrepresented in the science and engineering workforce, although to a lesser degree than in the past, with the <b>greatest disparities occurring in engineering, computer science, and the physical sciences</b> (<a href="#">NSF, Science &amp; Engineering Indicators, 2016</a>).</p> <p>Women make up half of the total U.S. college-educated workforce, but <b>only 29% of the science and engineering workforce</b>.</p> <p>Female scientists and engineers are concentrated in different occupations than are men, with relatively high shares of women in the social sciences (62%) and biological, agricultural, and environmental life sciences (48%) and <b>relatively low shares in engineering (15%) and computer and mathematical sciences (25%)</b>.</p> <p>For example:</p> <ul style="list-style-type: none"> <li>35.2% of chemists are women;</li> <li>11.1% of physicists and astronomers are women;</li> <li>33.8% of environmental engineers are women;</li> <li>22.7% of chemical engineers are women;</li> <li>17.5% of civil, architectural, and sanitary engineers are women;</li> </ul>        |

## Professional Development Presentation-Workshop

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|                                 |                                                                                     | <p>17.1% of industrial engineers are women;<br/>10.7% of electrical or computer hardware engineers are women; and<br/>7.9% of mechanical engineers are women.</p> <p>Source: <a href="https://nqcproject.org/statistics">https://nqcproject.org/statistics</a></p> <p>Ask participants to discuss with the person next to them (groups can be of 2-3 people): How does this gap affects society? In what ways? Think of two examples.</p> <p>Give them 5 minutes to discuss. After that, ask groups to share some of the examples they found.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 11                              |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p><b>Stereotype Threat</b></p> |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p><b>Growth Mindset</b></p>    |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 12                              |  | <p>(20 minutes)</p> <p>Facilitator: <i>The next finding addresses beliefs about intelligence. Believing in the potential for intellectual growth, in and of itself, improves outcomes.</i></p> <p><i>The research of Carol Dweck, a psychologist at Stanford University, provides evidence that a “growth mindset” as opposed to a “fixed mindset” is likely to lead to greater persistence in the face of adversity and ultimately success in any realm.</i></p> <p><i>The table shown here lays out the differences between a fixed mindset and a growth mindset.</i></p> <p><i>Individuals with a fixed mindset believe that intelligence is static and inborn. In contrast, individuals with a growth mindset believe that intelligence can be developed through effort.</i></p> <p><i>Individuals with a fixed mindset are susceptible to a loss of confidence when they encounter challenges because they believe that if they are truly “smart,” things will come easily to them. If they have to work</i></p> |

## Professional Development Presentation-Workshop

*hard at something, they tend to question their abilities and lose confidence, and they are likely to give up because they believe they are "not good" at the task and, because their intelligence is fixed, will never be good at it.*

*Individuals with a growth mindset, on the other hand, show a far greater belief in the power of effort, and in the face of difficulty, their confidence actually grows because they believe they are learning and getting smarter as a result of challenging themselves.*

*These research findings are especially important for women in science and engineering, because encountering obstacles and challenging problems is in the nature of scientific work.*

*When girls and women believe they have a fixed amount of intelligence, they are more likely to lose confidence and disengage from science and engineering when they inevitably encounter difficulties in their course work.*

*This is true for all students, but it is particularly relevant for girls in STEM subjects, where negative stereotypes persist about girls' abilities.*

*There are a number of steps we can take to foster a growth mindset in children:*

### Recommendations

- *Parents and teachers should teach children that intellectual skills can be acquired. When girls are taught that their intelligence can expand with experience and learning, girls do better on math tests and are more likely to want to continue to study math in the future.*


- *Praise children for effort. Rather than saying "Oh, you're so smart!", when children do something well, say "Wow, you worked really hard at that and you did it!"*

- *It is especially important to praise the ablest students for their effort. These students have often coasted along, gotten good grades, and been praised for their intelligence and may be the very students who opt out when the work becomes more difficult.*

- *Highlight the struggle.*

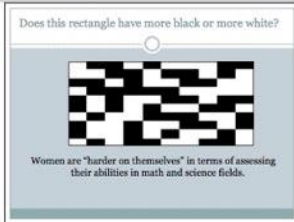


## Professional Development Presentation-Workshop

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|    |                                                                                   | <p>•Parents and teachers can communicate to students that we value and admire effort and hard work. This will teach children the values that are at the heart of scientific and mathematical contributions: love of challenge, love of hard work, and the ability to embrace and learn from our inevitable mistakes.</p> <p>•Talented and gifted programs should send the message that they value growth and learning, not just being “gifted” with intelligence.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 13 |  | <p>Facilitator: Another finding presented in the report is in the area of spatial skills.</p> <p>One of the largest gender differences in cognitive abilities is found in the area of spatial skills, with boys and men consistently outperforming girls and women, especially on measures of mental rotation, an example of which is shown here.</p> <p>See if you can answer this question. Does anyone want to volunteer what the answer is?</p> <p>Answer is D.</p> <p>Spatial skills are considered by many people to be important for success in engineering and other scientific fields and are often considered to be “innate”.</p> <p>Research conducted by Sheryl Sorby over a decade with first year engineering students at Michigan Tech, however, documents that individuals’ spatial skills consistently improve dramatically in a short time with a simple training course.</p> <p>If girls grow up in an environment with opportunities to develop their spatial skills, they are more likely to consider a future in a science or engineering field.</p> <p><u>Recommendation</u><br/>Playing with building toys as well as drawing can help children develop their spatial skills.</p> |

## Professional Development Presentation-Workshop

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*Sociologist Shelley Correll at Stanford University. Dr. Correll's research finds that women are "harder on themselves" compared to their male peers when assessing their abilities in math and science.*

*Dr. Correll first became interested in gender differences in self-assessment when she taught chemistry to high school students. She realized that no matter how well the girls in her classes did, she had trouble convincing them that they had any scientific ability. At the same time, she found that no matter how poorly the boys in her classes did, they continued to believe that they were very good at chemistry.*

*She found that, in fact, girls do assess their mathematical abilities lower than boys with similar past mathematical achievements.*

*In a lab experiment on gender differences in self-assessment, Dr. Correll found that women assess themselves as less competent in "male" fields, even when the "male" field is fictitious.*

*Here we have an example from this experiment. See if you can answer this question: Does this rectangle have more black or more white?*

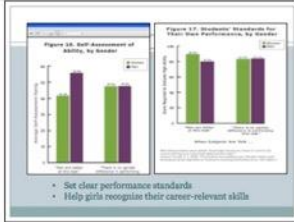
*We won't spend too much time here because it's not actually important how much black or white there is, but what the results of the study showed.*

*In Dr. Correll's experiment, she identified this fictitious ability to detect correct proportions of black and white as "**contrast-sensitivity ability**". When participants were told that men were more likely to have high levels of "contrast-sensitivity ability", women assessed their contrast-sensitivity ability lower than men did.*

*When this ability was described as equally strong in men and women, gender differences in self-assessment were not found.*

## Professional Development Presentation-Workshop

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*Facilitator: This gender difference in self-assessment is shown here in the chart on the left.*

*[Explanation of chart: The chart shows women's self-assessments in green and men's self-assessments in purple. When subjects were told that men are better at this task, men assessed their "contrast-sensitivity" abilities much higher than women. When subjects were told that there is no gender difference in performing this task, however, there was essentially no difference between how men and women assessed their abilities.]*

*At the same time, girls held themselves to a higher standard than boys when told that men are better at "contrast-sensitivity" but men and women's standards were nearly identical when told that there is no gender difference.*

*Women's standards are in green and men's standards in purple. When subjects were told that men are better at this task and then asked "how high would you have to score to believe that you have high ability in this area", women said they would have to score around 89%. Men, in contrast, said they would have to score around 79%. This is a full 10 percentage point difference! When subjects were told that there is no gender difference in performing this task, however, there was essentially no difference between the standard that men and women held themselves to.]*

*If you think about this finding as it relates to math and science, fields in which men are considered to excel, it suggests that girls believe that they have to be better in math and science than boys believe they have to be in order to think of themselves as good in these fields.*

***There are many elements to choosing a career, but researchers agree that one element is believing that you can be successful at it.***

*Girls' lower self-assessment of their math ability, even in the face of good grades and test scores, along with their higher standard for performance in "masculine" fields, helps explain why fewer girls than boys aspire to science and engineering careers.*

*So what can be done to reduce gender differences in self-assessment?*

## Professional Development Presentation-Workshop

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|  | <p><u>Recommendations</u></p> <p><i>First, as many of you know, extremely low average test scores are common in many college science and engineering courses. Low scores increase uncertainty in all students, but they have a more negative effect on students who already feel like they don't belong, as many women in science and engineering majors do.</i></p> <p><i>The same letter or number grade on an assignment or exam might signal something different to girls than it does to boys.</i></p> <p><b>Female students may need to be reminded that a B in a difficult course is a grade to be proud of. The more that teachers and professors can reduce uncertainty about students' performance, the better.</b></p> <p><i>And second, girls are less likely than boys to interpret their academic successes in math and science as an indication that they have the skills necessary to become a successful engineer or computer scientist.</i></p> <p><i>Encourage girls to see their success in high school math and science for what it is: not just a requirement for going to college but also an indication that they have the skills to succeed in a whole range of science and engineering professions.</i></p> |
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| <p><b>Gender Bias in the Classroom</b></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <p>16</p>                                  | <div data-bbox="430 1115 722 1333" data-label="Image"> </div> <p>(20 minutes)</p> <p>Facilitator: <i>now I will share a few scenarios where gender bias has been observed. As I share them think if you have ever experienced or witnessed similar situations. After I share them, we'll get in groups and discuss how can these messages and situations can affect girls' interest in science and engineering. Is there anything you can do to change these messages or situations?</i></p> <p><b>Situation #1:</b> <i>Girls are often assigned to passive roles such as reading instructions, recording results, or taking notes, while boys use equipment and complete the tasks.</i></p> |





## Professional Development Presentation-Workshop

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| <p>17</p>                                   | <p>The Facts: Gender Bias in the Classroom</p> <p>Teachers often give girls less meaningful and less critical praise than boys. Boys' work is praised for content, while girls' work is often praised for its appearance. (Liu, 2006)</p>  | <p><i>Situation #2: Teachers often give girls less meaningful and less critical praise than boys. Boys' work is praised for content, while girls' work is often praised for its appearance.</i></p> |
| <p>18</p>                                   | <p>The Facts: Gender Bias in the Classroom</p> <p><b>Listener Bias:</b><br/>Males talk <b>2.5 times</b> longer than females in classrooms but are seen as talking the same or less. (Krupnick, 1985)</p>                                   | <p><i>Situation #3: Males talk 2.5 times longer than females in classrooms but are seen as talking the same or less.</i></p>                                                                        |
| <p>19</p>                                   | <p>The Facts: Gender Bias in the Classroom</p> <p>In one study, boys called out answers <b>8 times</b> more than girls and were likely to be listened to.<br/>Girls who shouted out answers were instructed to raise their hands.</p>     | <p><i>Situation #4: In one study, boys called out answers 8 times more than girls and were likely to be listened to. Girls who shouted out answers were instructed to raise their hands</i></p>     |
| <p><b>Gender Roles in Communication</b></p> |                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                     |
| <p>20</p>                                   | <p>The Facts: Gender Roles in Communication</p> <p>Parents and teachers interrupt girls <b>twice</b> as often as boys.</p>                                                                                                               | <p><i>Situation #5: Parents and teachers interrupt girls twice as often as boys.</i></p>                                                                                                            |
| <p><b>Gender Roles in the Museum</b></p>    |                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                     |
| <p>21</p>                                   | <p>The Facts: Gender Roles at the Museum</p> <p>Boys are <b>three times</b> more likely than girls to hear explanations of science from their parents (Crowley, 2001).</p>                                                               | <p><i>Situation #6: Boys are three times more likely than girls to hear explanations of science from their parents (Crowley, 2001).</i></p>                                                         |

## Professional Development Presentation-Workshop

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| 22                                          | <p>The Facts: Gender Roles at the Museum</p> <p>Boys are more likely to jump in and play, while girls are more thoughtful in their approach (Wohre and Harrasser, 2011).</p>                                                                                                                                                                                                                                                                                                                                                                     | <p><i>Situation #7: Boys are more likely to jump in and play, while girls are more thoughtful in their approach.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <p><b>Discussion</b></p>                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 23                                          | <p>Discussion</p> <p>Where have you seen gender bias like this before?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>Facilitator: <i>Let's discuss in small groups (2-3 people): Where have you seen gender bias like this before? How can we change this messages in our communities/schools/families?</i></p> <p><i>Let's take 10 minutes to discuss and then we'll share with the big group.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p><b>Strategies for Engaging Girls</b></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 24                                          | <p>Strategies for Engaging Girls</p> <p><i>Use inclusive language:</i> Watch the pronouns you use. When speaking about a scientist, do you say "he" or "his"?</p> <p><i>Feature female role models:</i> Feature images and stories about women. Showcase real female scientists and engineers.</p> <p><i>Make it social:</i> Encourage sharing and discussion of the activity with friends or family. Consider assigning roles so that every student has an active role to play.</p>                                                           | <p>(20 minutes)</p> <p>Facilitator: <i>We have discussed gender bias and challenging scenarios that affect how girls are included in science and engineering. Now we'll talk about specific strategies to engage girls in positive ways.</i></p> <ul style="list-style-type: none"> <li>• <b>Use inclusive language:</b> Watch the pronouns you use. When speaking about a scientist, do you say "he" or "his"?</li> <li>• <b>Feature female role models:</b> Feature images and stories about women. Showcase real female scientists and engineers.</li> <li>• <b>Make it social:</b> Encourage sharing and discussion of the activity with friends or family. Consider assigning roles so that every student has an active role to play.</li> </ul> |
| 25                                          | <p>Strategies for Engaging Girls</p> <p><i>Engage the senses:</i> Use a variety of colors, sounds, smells, and textures.</p> <p><i>Tell a story:</i> Tell a story students can relate to. This could be the story of the person who discovered the technology in the activity or a story of someone who might use this technology. Encourage students to tell their own stories.</p> <p><i>Highlight altruism:</i> Feature ways science and engineering has been used to help people, or ways that it may one day be used to help others.</p>  | <ul style="list-style-type: none"> <li>• <b>Engage the senses:</b> Use a variety of colors, sounds, smells, and textures.</li> <li>• <b>Tell a story:</b> Tell a story that students can relate to. This could be the story of the person who discovered the technology in the activity or a story of someone who might use this technology. Encourage students to tell their own stories.</li> <li>• <b>Highlight altruism:</b> Feature ways science and engineering has been used to help people, or ways that it may one day be used to help others.</li> </ul>                                                                                                                                                                                    |

## Professional Development Presentation-Workshop

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| 26 |  <p>What can YOU do to better engage girls in science?</p> | <p>Self-reflection time</p> <p>Facilitator: <i>now we'll take five minutes to reflect about the things we can do to better engage girls in science and engineering. Think about the discussions we had today and the strategies we just shared, and write 1-2 ideas.</i></p> <p>Give the group five minutes, then ask them to share their thoughts.</p> <p>Encourage participants to write ideas down and take them with them as reminder of actions they want to take.</p> |
| 27 |  <p>Final questions and comments</p>                       | <p>(5 minutes)</p> <p>Facilitator: <i>do you have any final questions/comments?</i></p> <p>Give the group 5 minutes</p> <p>Facilitator: <i>Thank you so much for coming and participating!</i></p>                                                                                                                                                                                                                                                                          |

### RESOURCES

- **SciGirls** is a PBS Kids show that encourages **girls** in science, technology, engineering and mathematics or STEM <http://pbskids.org/scigirls/home>
- The EngineerGirl website is designed to bring national attention to the exciting opportunities that engineering represents for girls and women <http://www.engineergirl.org/>

Professional Development Presentation-Workshop



# Engaging Girls in Engineering and Science

**Goal:**

Enjoy engineering-related activities, see the value in engineering, and feel comfortable with the idea of supporting girls in their lives in engineering activities or pursuits.

**Topics:**

Engineering, strategies to facilitate science-related activities

**SITE REQUIREMENTS**

- Projector and screen for showing PowerPoint.
- Tables and chairs for participants.
- Paper, pencils, markers (for the Tower Challenge)

**TIME REQUIRED**

**Advance Preparation**



60 min

**Set Up**



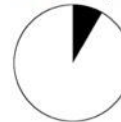
10 min

**Activity**



60-120 min

**Clean Up**



5 min

**INTRODUCTION**

- This is meant to guide professionals that want to deliver trainings/workshops to support adults/caregivers in increasing their comfort supporting girls in engineering-related activities.
- The content can be adapted to shorten or increase the length of the training, and each facilitator can infuse it with their own style.
- It has been observed that participants are often comfortable working and having discussions in small groups as topics and questions can be personal and emotional for some people.
- It's important to approach the topic with sensibility. Gender equity and parenting can be topics that trigger different emotions and responses for different people.
- It's important that the facilitator keeps this in mind and adapts the content and length of discussions to serve the needs of each group.

**Notes:**

- Print copies of the PowerPoint presentation for all participants.
- Suggested script for the facilitator appears in the text in italics. The script is flexible. The facilitator should get familiar with the content and present it in a way that works for them and the group.



## Professional Development Presentation-Workshop



### AGENDA

This agenda is meant to be used as a guide to organize the content of your session. Feel free to adapt it to meet the needs of your session/group. The times listed at the top of each section are approximates. Some discussions can take longer due to the group's background/interests.

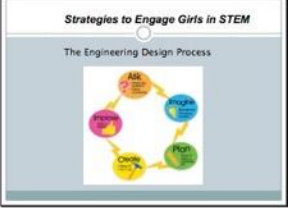
- Welcome group (location of restrooms, introductions, nametags, etc.) - 10 minutes
- Hands-on activity: "Tower Challenge" - 30 minutes
- The engineering design process - 30 minutes
- Strategies to engage girls in engineering and science-related activities - 45 minutes
- Closure/Questions - 5 minutes

### INSTRUCTOR-LED ACTIVITY

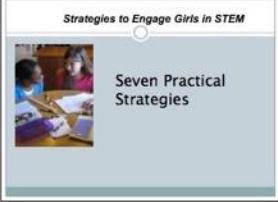
### Slide Show

| <b>SciGirls Seven: Strategies to Engage Girls in STEM</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                         | <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; font-size: small;">Strategies to Engage Girls in STEM</p>  <p><b>Goals</b></p> <ul style="list-style-type: none"> <li>• Enjoy engineering-related activities.</li> <li>• See value in engineering.</li> <li>• Feel comfortable with idea of supporting girls in their lives in engineering activities/pursuits</li> </ul> </div>                                                                                                                                                                                                    |
|                                                           | <p>(10 minutes)</p> <p>Welcome participants.</p> <p>Housekeeping details.</p> <p>Go through the session goals.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2                                                         | <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; font-size: small;">Strategies to Engage Girls in STEM</p>  <p style="text-align: center; font-weight: bold;">Tower Challenge!</p> </div>                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                           | <p>(30 minutes)</p> <p>Ask participants to form groups of 2-4 people (make groups smaller or bigger as needed.)</p> <p>Each group should have the following materials:</p> <ul style="list-style-type: none"> <li>• 100 index cards</li> <li>• 2 feet of tape</li> <li>• One stuffed animal (it should be about the same size and weight for all groups.)</li> <li>• Measuring tape or ruler.</li> </ul> <p>You can also have paper, pencils and markers on the tables, in case groups want to design, draw, or plan, as part of their process.</p> <p>Facilitator presents challenge.</p> <p><i>Can you build a stable structure that's at least a foot tall using index cards, in order to display a small stuffed</i></p> |




## Professional Development Presentation-Workshop

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|          |                                                                                    | <p><i>animal for 10 seconds?</i></p> <p>Give participants 10 minutes to work in groups.</p> <p>After the 10 minutes ask everyone to stop working on their structures.</p> <p>The facilitator goes group by group to test the structures by placing the stuffed animal on top of the structure and counting to 10. The rest of the group observes.</p> <p>Questions that can be asked by facilitator as groups test the structures:</p> <ul style="list-style-type: none"> <li>• <i>How did you come up with the design?</i></li> <li>• <i>What was challenging about building the structure?</i></li> <li>• <i>What things would you change to make your structure more stable?</i></li> </ul>                                                                                                                                                                                                                                                                                                                                                          |
| <p>3</p> |  | <p>(30 minutes)</p> <p>The engineering design process</p> <p>Facilitator: <i>What steps did you follow to come up with and build your design?</i></p> <p>Let people brainstorm for 2-3 minutes. Ask groups to share what they discussed. You can write the answers on the board/paper.</p> <p>Facilitator: <i>Some/all of the steps you shared are part of the engineering design process. The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. Many times, the solution involves designing a product (like a machine or computer code) that meets certain criteria and/or accomplishes a certain task.</i></p> <p><i>"Engineers do not always follow the engineering design process steps in order, one after another. It is very common to design something, test it, find a problem, and then go back to an earlier step to make a modification or change to the design. This way of working is called <b>iteration</b>, and it is likely that your process will do the same!"</i></p> |

## Professional Development Presentation-Workshop


|   |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                                                                                     | <p>Source: <a href="http://www.sciencebuddies.org/engineering-design-process/engineering-design-process-steps.shtml">http://www.sciencebuddies.org/engineering-design-process/engineering-design-process-steps.shtml</a></p> <p><b>ASK:</b> What is the problem? How have others approached it? What are your constraints?</p> <p><b>IMAGINE:</b> What are some solutions? Brainstorm ideas. Choose the best one.</p> <p><b>PLAN:</b> Draw a diagram. Make lists of materials you will need.</p> <p><b>CREATE:</b> Follow your plan and create something. Test it out!</p> <p><b>IMPROVE:</b> What works? What doesn't? What could work better? Modify your design to make it better. Test it out!</p> <p>Source: <a href="http://eie.org/overview/engineering-design-process">http://eie.org/overview/engineering-design-process</a></p> <p>When creating the tower during the challenge, what questions did you asked? How did you create a plan? Did you test it? How? What would you do different?</p> <p>If times allows, the tower challenge can be repeated, letting the engineering design process inform the iteration.</p> |
| 4 |  | <p>(45-60 minutes)</p> <p>Facilitator: <i>We have tried a simple engineering activity and explored the engineering design process. Now we are going to talk about seven strategies that we can use to engage girls in science and engineering activities in a positive way.</i></p> <p>Ask participants to get into small groups (2-3 people). Preferably the same groups that did the Tower Challenge together.</p> <p>Facilitator: <i>Now I am going to give each group a strategy (strategies can be written in index cards). Read the strategy and think about the activity we just did (The Tower Challenge). Discuss among your groups how this strategy can be integrated into this activity. How</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                     |

## Professional Development Presentation-Workshop




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|   |                                                                                     | <p>can this strategy be integrated through other activities?</p> <p>Take 10 minutes to brainstorm among your groups and we'll share with the entire group afterwards.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 5 |    | <p>Ask the participants that had <b>Strategy 1</b> to share what they discussed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 6 |    | <p><i>Facilitator: Thank you for sharing your ideas. Here are some other tips that we can practice to encourage collaboration among girls when doing engineering/science related activities.</i></p> <p><b>Tips</b></p> <p><b>Create an atmosphere that is open and positive.</b> Start with activities to “break the ice,” involving communication and teamwork.</p> <p><b>Encourage working in small groups.</b> Use various methods for forming groups, keeping in mind that kids should be grouped with different members from time to time.</p> <p><b>Speak up promptly if a girl makes a distasteful remark, even jokingly.</b> Set the rules at the start: no teasing or unfriendly talk. Explain why a comment is offensive or insensitive. If conflicts arise, resolve them through group (or pair) dynamics, in which each person voices what they think happened and how it made them feel. Then work on agreement and resolution.</p> |
| 7 |  | <p>Ask the participants that had <b>Strategy 2</b> to share what they discussed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |





## Professional Development Presentation-Workshop

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| <p>8</p> |  <p><b>SciGirls Seven</b></p> <ul style="list-style-type: none"> <li>• Connect the material to the girls' lives</li> <li>• Share how you feel personally connected to the material</li> <li>• Offer lots of examples</li> <li>• Find out what the girls already know (or don't)</li> <li>• Make connections between their experience and the STEM field</li> </ul> | <p><i>Facilitator: Thank you for sharing your ideas. Here are some other tips that we can practice to encourage personal connections when doing engineering/science related activities.</i></p> <p><b>Tips</b></p> <p><b>Look for ways to connect the material to the girls' lives.</b> How is the activity connected to the girl's life? Thinking about the Tower Challenge, what questions can you ask that are connected to your everyday life? (Examples of questions: Where have we seen a tall building? What shape did it have? What do engineers need to think about when building a tall structure? Why?)</p> <p><b>Demonstrate and talk about your own enthusiasm</b> for the material, the challenge, the activity, and how it affects you personally.</p> <p><b>Create a "need to know."</b> As you are preparing activities, ask yourself—why would kids/girls need to know this? Ask girls to prepare a table of their thoughts, including: what they know, want to know, have learned, and how they can learn more. Use this in groups or individually as a tool for tapping into prior knowledge and encouraging personal reflection.</p> <p><b>Use case studies/real scenarios.</b> Kids generally relate to characters who face decisions or dilemmas; they often make connections from the story to their own lives.</p> <p><b>Use follow-up questions</b> that focus kids' attention on ideas or assumptions embedded in their first answers. These questions can help girls explore and express what they know even when they aren't sure they know it. For example: Tell me more. Then what? Could you give me an example?</p> |
| <p>9</p> |  <p><b>SciGirls Seven</b></p> <p><b>Strategy 3</b></p> <p>Girls enjoy hands-on, open-ended projects and investigations. (Chatman, Nielsen, Strauss, &amp; Tanner, 2008; Burkam, Lee, &amp; Smerdon, 1997; Fanscail, 2002)</p>                                                                                                                                    | <p>Ask the participants that had <b>Strategy 3</b> to share what they discussed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |



## Professional Development Presentation-Workshop

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| <p>10</p> |  <p><b>SciGirls Seven</b></p> <ul style="list-style-type: none"> <li>Try an activity without step-by-step directions.</li> <li>Pose questions using "what" or "how."</li> <li>Encourage girls to suggest approaches to a problem.</li> <li>Resist answering the question, "Is this right?"</li> </ul>                              | <p><i>Facilitator: Thank you for sharing your ideas. Here are some other tips that we can practice to encourage open-ended projects and investigations.</i></p> <p><b>Tips</b></p> <p><b>Try an activity without step-by-step directions. Don't shortchange your girls by assuming they can't do an investigation without prescribed directions. Release their inner explorers and let them surprise you!</b></p> <p><b>Pose questions using "what" or "how."</b> Instead of, "Is noise considered a pollutant?" try, "How can you test whether noise is a pollutant?" or "Is this building/structure safe?" try, "How can we test whether this building/structure is safe?"</p> <p><b>Encourage girls to suggest approaches to a problem.</b> Instead of swooping in to rescue them, encourage girls to problem solve by identifying, drawing, or labeling things they do understand.</p> <p><b>Resist answering the question, "Is this right?"</b> Highlight unexpected results and suggest ways for girls to investigate further by asking, "How could we figure that out?" or, "What do you think?"</p> |
| <p>11</p> |  <p><b>SciGirls Seven</b></p> <p><b>Strategy 4</b><br/>Girls are motivated when they can approach projects in their own way, applying their creativity, unique talents and preferred learning styles. (Eisenhart &amp; Finkel, 1996; Calabrese Barton, Tan, &amp; Rivet, 2008)</p>                                               | <p>Ask the participants that had <b>Strategy 4</b> to share what they discussed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p>12</p> |  <p><b>SciGirls Seven</b></p> <ul style="list-style-type: none"> <li>Allow girls to design their own experiments and tests.</li> <li>Let girls communicate their findings using a variety of techniques</li> <li>Use your girls' language to reiterate their points.</li> <li>Ask girls to write personal narratives.</li> </ul> | <p><i>Facilitator: Thank you for sharing your ideas. Here are some other tips that we can practice to encourage girls to experiment and be creative when doing engineering/science related activities.</i></p> <p><b>Tips</b></p> <p><b>Allow girls to design their own experiments and tests.</b> Girls can share their plans with you; but your role is as a facilitator rather than as a leader or expert. Emphasize that everyone is learning and discovering together.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

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|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>Let girls communicate their findings using a variety of techniques</b> relevant to their lives: poetry, music, posters, plays, slideshows, 2D- and 3D-models, drawings, etc.</p> <p><b>Use your girls' language to reiterate their points.</b> Use a board, notebook, or large sheet of paper to document participation. Write the idea as you hear it—don't reword unless you have permission from the child/participant. When meanings are unclear, restate what the girl said in their own words first, and then ask her to expand on her thinking with, "Tell me more" or, "What makes you think that?"</p> <p><b>Ask girls to write personal narratives</b> relating to a particular time or place. A journal or blog (for older girls) provides an avenue for reflection on learning.</p>                                                                                |
| <p>13</p> |  <p>The slide features the SciGirls logo and the title 'SciGirls Seven'. It highlights 'Strategy 5' with the text: 'Girls' confidence and performance improves in response to specific, positive feedback on things they can control - such as effort, strategies and behaviors. (Halpern, et al., 2007; Zaidin &amp; Pajares, 2000; Blackwell, Trzesniewski, &amp; Sorich Dweck, 2007; Mueller &amp; Dweck, 1998)'. There is a small image of girls working together.</p>     | <p>Ask the participants that had <b>Strategy 5</b> to share what they discussed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>14</p> |  <p>The slide features the SciGirls logo and the title 'SciGirls Seven'. It lists several tips: 'Let a girl know you believe she can improve and succeed over time.', 'Avoid statements such as, "You're really good at this!"', 'Convey the same confidence in the abilities of all your girls.', 'Reward success publicly and immediately.', and 'Emphasize that working scientists struggle and make mistakes, too.' There is a small image of girls working together.</p> | <p><b>Facilitator: Thank you for sharing your ideas. Here are some other tips that we can practice to improve confidence among girls when doing engineering/science related activities.</b></p> <p><b>Tips</b></p> <p><b>Reward success publicly and immediately.</b> Focus on specific contributions such as, "You were really thinking outside the box with that design" or, "I love the way you and Maria worked together to solve that problem."</p> <p><b>Avoid statements such as, "You are really good at this!"</b> It sends the message that success doesn't require effort or struggle.</p> <p><b>Convey the same level of respect for and confidence in the abilities of all your girls/children.</b> Introduce girls to the good work done by their peers/siblings. Share the ideas, knowledge, and accomplishments of individuals with the group/family as a whole.</p> |

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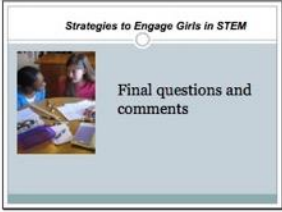
|    |                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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|    |                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p><b>Let a girl know you believe she can improve and succeed over time.</b> When you identify a child's weakness, make it clear that your comments relate to a particular task or performance, not to the child as a person. The brain is a "muscle" that can get stronger with time; skills can be improved with practice.</p> <p><b>Emphasize that working scientists struggle and make mistakes, too.</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 15 |  <p>The slide features the SciGirls logo and the text: "Strategy 6 Girls gain confidence and trust in their own reasoning when encouraged to think critically. (Chatman, et al., 2008; Eisenhart &amp; Finkel, 1998)". It includes an image of three girls in hard hats working together.</p>                                                              | <p>Ask the participants that had <b>Strategy 6</b> to share what they discussed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 16 |  <p>The slide features the SciGirls logo and the text: "SciGirls Seven". It lists four tips: "Support an environment free of 'instant answers.'", "Think like scientists and engineers.", "Make sure every girl has a chance to speak/ask questions", and "It's okay to disagree." It includes an image of three girls in hard hats working together.</p> | <p><i>Facilitator: Thank you for sharing your ideas. Here are some other tips that you can practice to encourage girls to gain confidence and trust their own reasoning when doing engineering/science related activities.</i></p> <p><b>Tips</b></p> <p><b>Support an environment free of "instant answers."</b> By working through a problem, girls will experience a sense of achievement and confidence that will increase their motivation to learn. When you simply give kids the solution, you rob them of the chance to think for themselves. Address girls' anxiety about not getting the answer by refocusing their attention on the problem at hand. Build on what they do know to move forward.</p> <p><b>Think like scientists and engineers.</b> It is okay to make mistakes; there is more than one way to solve a problem. Experimentation may never lead to an answer, but rather to new questions. Practice developing alternative explanations for results.</p> <p><b>Meet a question quota.</b> Insist on each girl asking a certain number of questions each day.</p> <p><b>It's okay to disagree.</b> Stress the importance of considering different approaches and viewpoints. When disagreements arise, allow girls to voice their viewpoint while all others listen. Remind girls of the</p> |



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|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><i>importance of using solid evidence when making a claim. Consensus may be difficult and perhaps unnecessary, but listening to one another is important.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 17 |  <p>The slide features the SciGirls logo and the title 'SciGirls Seven'. It highlights 'Strategy 7' with the text: 'Girls benefit from relationships with role models and mentors. L. 2009, et al., 2010. Source: Whipple &amp; Wang, 2010.' There is a small image of three girls in lab coats and hard hats.</p>                                                                                                           | <p>Ask the participants that had <b>Strategy 7</b> to share what they discussed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 18 |  <p>The slide features the SciGirls logo and the title 'SciGirls Seven'. It lists several bullet points: 'Invite guests to speak, or help lead an activity.', 'Spotlight women who work on the subjects you are studying.', 'Show videos of female scientists.', 'Use SciGirls videos to showcase peers as mentors.', and 'Encourage mentor pairings.' There is a small image of three girls in lab coats and hard hats.</p> | <p><i>Facilitator: Thank you for sharing your ideas. Here are some other tips that we can practice to encourage relationship building with female engineers and scientists.</i></p> <p><b>(This particular strategy might not apply or be less accessible for some audiences, parents for example. You can adapt it to make it relevant, only highlighting what you think will connect with your participants. Also, you can share only six of the seven strategies if it seems appropriate.)</b></p> <p><b>Tips</b></p> <p><b><i>Invite guest speakers from all levels, including high school, undergraduate, and graduate students, along with professional scientists. Probe visitors to describe what their work looks like along with how they identify and ask questions, answer them, and share information with others. Remind them to talk about their hobbies, interests, family and life outside of the lab.</i></b></p> <p><b><i>Invite guest scientists to help lead an activity. If you are unsure of their comfort level working with children, pair them with other educators or leaders. The experience will be valuable for both the students and the scientists!</i></b></p> <p><b><i>Spotlight women who work on the subjects you are studying.</i></b></p> <p><b><i>If you can't get someone live, show videos of female scientists. (Use SciGirls videos or DragonflyTV's scientist profiles at scigirlsconnect.org).</i></b></p> <p><b><i>Use SciGirls videos to showcase peers as mentors.</i></b></p> |

## Professional Development Presentation-Workshop

|    |                                                                                   |                                                                                                                                                                                                    |
|----|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                   | <p><i>The girls in each episode can act as role models for projects.</i></p> <p><b>Encourage mentor pairings.</b></p>                                                                              |
| 19 |  | <p>(5 minutes)</p> <p>Facilitator: <i>Do you have any final questions/comments?</i></p> <p>Give the group 5 minutes</p> <p>Facilitator: <i>Thank you so much for coming and participating!</i></p> |

### RESOURCES

- **SciGirls** is a PBS Kids show that encourages **girls** in science, technology, engineering and mathematics or STEM <http://pbskids.org/scigirls/home>
- The EngineerGirl website is designed to bring national attention to the exciting opportunities that engineering represents for girls and women <http://www.engineergirl.org/>

## Appendix C: Content of Reflective Discussions

Tuesday, August 15, 2017 at 2:01:21 PM Central Daylight Time

**Subject:** DOW Reflective Discussions Agendas  
**Date:** Tuesday, May 23, 2017 at 7:01:09 PM Central Daylight Time  
**From:** Veronika Nunez  
**To:** Cecilia Garibay, Rebecca Teasdale  
**CC:** Smirla Ramos-Montanez, Lauren Moreno  
**Attachments:** image002.png, image001.gif, image003.png, Tips for effectively facilitating activities.doc, Diseñando nuestro mundo Presentacion para padres Dic 2015.pptx

Hola Cecilia and Rebecca,

I hope all is well.

As promised, here are the three agendas that framed our reflective conversations with Adelante Mujeres.

Also, attached is the document with strategies/tips to facilitate engineering activities (part of our second meeting/strategies for engaging girls in engineering), and the PowerPoint I used for the orientation (first meeting.)

Let me know if you have further questions. I am more than happy to answer via email or phone.

### **Meeting #1 agenda themes:**

Overview of DOW (2-hour orientation)

- Goals, our three pillars (altruism, social, personal)
- Activities, build a calendar, expectations, roles
- Review last cohort activities.

### **Meeting #2 agenda themes:**

Overview of sessions and review of DOW activities.

- Communication
- Cohort Activities
- Success & challenges
- Strategies for engaging girls in engineering

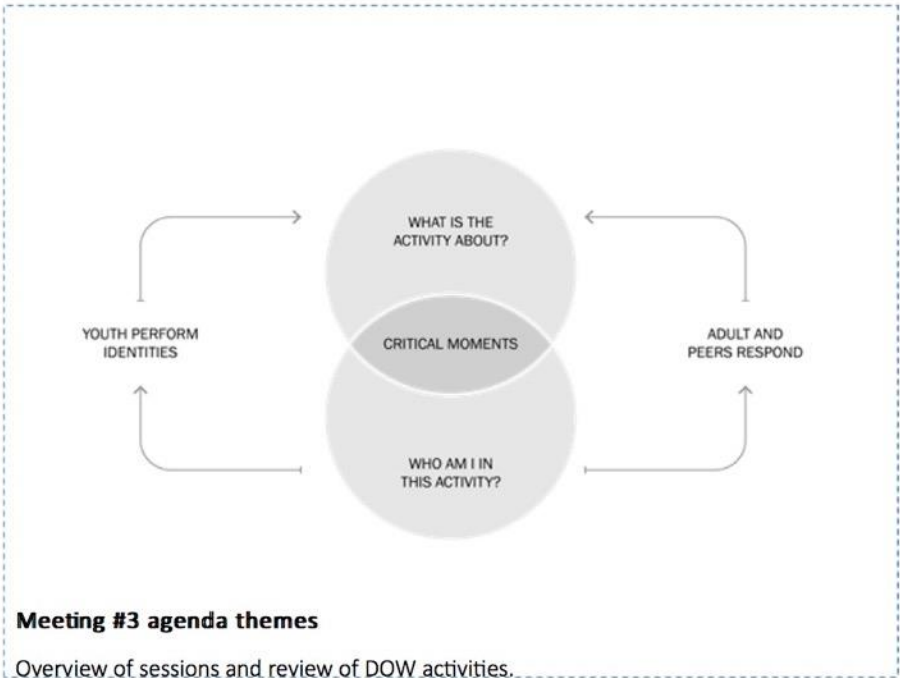
Research discussion:

- Activity frames and reflective practice

Discussion/Questions:

- How, if at all, do you think that facilitators could benefit from reflecting on program sessions?
- What are some unspoken expectations and understandings that you have for your program sessions?
- What kinds of skills do your leadership programs focus on cultivating?
- Are there any program elements or considerations that are specific to the communities you serve? If so, what are these and how do you think they are unique?

Page 1 of 3



- Communication
- Cohort Activities
- Success & challenges
- Implicit bias
- Growth mind-set

**Notes:** During the implicit bias and growth mind-set discussion, we talked about personal experiences, particularly tie to cultural practices.

**Other messages:**

- We all have implicit biases.
- They do not necessarily align with our declared beliefs.
- We can hold them against our own in-group.
- They can be unlearned.
- Parents and teachers should teach children that intellectual skills can be acquired
- Praise effort. Be specific about progress (“you were creative about solving this” and point the solution.)

**Research Discussion/Questions:**

- What are some useful ways of presenting findings to the AM team?



- How could this work be presented back to communities?
- REVEAL model
- Other experiences with similar models?

**Best,**

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[facebook.com/omsi.museum](https://facebook.com/omsi.museum) | [twitter.com/omsi](https://twitter.com/omsi)

### Appendix D: Photos of DOW Exhibition



Bridge component



Water component



Shake table 1



Shake table 2



Wind component



Text/image panels

**Appendix E: Girls' Responses to "What is Engineering?"**

| Category                 | Pre-program survey response                                                                                | Post-program survey response                                                                                                       |
|--------------------------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Pre-survey response only | <i>No lo se (I don't know)</i>                                                                             |                                                                                                                                    |
|                          | <i>Engineering is (when) a person designs or creates things.</i>                                           |                                                                                                                                    |
|                          | <i>I would say engineering is creating something</i>                                                       |                                                                                                                                    |
|                          | <i>Es una persona que cea cosas o disena cosas. (It's a person that creates things and designs things)</i> |                                                                                                                                    |
|                          | <i>Engineering is about solving problems</i>                                                               |                                                                                                                                    |
| A                        | <i>Can you help me? I don't know what engineering</i>                                                      | <i>Que es mucho computadoras (That it's a lot of computers)</i>                                                                    |
|                          | <i>?</i>                                                                                                   | <i>Aprende mucho y te diviertes (They learn a lot and you have fun)</i>                                                            |
|                          | <i>I don't know what engineering means.</i>                                                                | <i>They're project-making people</i>                                                                                               |
|                          | <i>"Can you help me" is engineering</i>                                                                    | <i>Engineering is fun</i>                                                                                                          |
|                          | <i>I don't know</i>                                                                                        | <i>It was so interesting, so many machines</i>                                                                                     |
| B                        | <i>Engineering is a person who creates or makes things/stuff.</i>                                          | <i>Ingenieria es alguien que inventa. (Engineering is someone who invents)</i>                                                     |
|                          | <i>It's a person who builds stuff.</i>                                                                     | <i>Personas que construyen cosas (People who build things)</i>                                                                     |
|                          | <i>It's a person who comes up with cool gadgets to make peoples' life easier.</i>                          | <i>It's when you come up with ways to help other people</i>                                                                        |
|                          | <i>Que es muy divertido (It's very fun)</i>                                                                | <i>Es donde puede hacer (It's where you get to do/make things)</i>                                                                 |
|                          | <i>I think it's about a person who makes things.</i>                                                       | <i>Es algo que ayuda a muchas personas (It's something that helps a lot of people)</i>                                             |
|                          | <i>Engineering is something that you can build in your own design</i>                                      | <i>It's art and creating new and helpful creations</i>                                                                             |
|                          | <i>Ingenierio es cual algien andas estudiando. (Engineering is when someone keeps on studying)</i>         | <i>Engineering is interesting</i>                                                                                                  |
|                          | <i>Engineering is a job that people can create or discover new things. (OMSI)</i>                          | <i>Es algo maravilloso; incluyendo ciencias, matematicas, y mas (It is something marvelous, including science, math, and more)</i> |
|                          | <i>It's something that involves science</i>                                                                | <i>Hard, creative, imagine</i>                                                                                                     |
| C                        | <i>Someone who builds</i>                                                                                  | <i>IDK (I don't know)</i>                                                                                                          |

## Appendix F: Girls' Responses to: "What are three examples of what engineers do?"

| Group                    | Pre-program survey response                                                                                                                                               | Post-program survey response                                                                                                                                                                               |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pre-survey response only | <ol style="list-style-type: none"> <li>1. <i>Disenar (Designing)</i></li> <li>2. <i>Crear (Creating)</i></li> <li>3.</li> </ol>                                           |                                                                                                                                                                                                            |
| A                        | <ol style="list-style-type: none"> <li>1. <i>I don't know</i></li> <li>2.</li> <li>3.</li> </ol>                                                                          | <ol style="list-style-type: none"> <li>1. ?</li> <li>2. ?</li> <li>3. ?</li> </ol>                                                                                                                         |
| B                        | <ol style="list-style-type: none"> <li>1. ?</li> <li>2. ?</li> <li>3. ?</li> </ol>                                                                                        | <ol style="list-style-type: none"> <li>1. <i>Fix things</i></li> <li>2. <i>Making things</i></li> <li>3. <i>Help you learn</i></li> </ol>                                                                  |
|                          | <ol style="list-style-type: none"> <li>1. <i>No</i></li> <li>2. <i>Lo</i></li> <li>3. <i>Se</i></li> </ol> <i>(I. Don't. Know.)</i>                                       | <ol style="list-style-type: none"> <li>1. <i>Build</i></li> <li>2. <i>Create</i></li> <li>3. <i>Experiment</i></li> </ol>                                                                                  |
|                          | <ol style="list-style-type: none"> <li>1. <i>I don't know</i></li> <li>2.</li> <li>3.</li> </ol>                                                                          | <ol style="list-style-type: none"> <li>1. <i>Areglar (Fixing)</i></li> <li>2. <i>Ayudar (Helping)</i></li> <li>3. <i>Construir (Building)</i></li> </ol>                                                   |
|                          | <ol style="list-style-type: none"> <li>1. <i>No lo se (I don't know)</i></li> <li>2. <i>No lo se (I don't know)</i></li> <li>3. <i>No lo se (I don't know)</i></li> </ol> | <ol style="list-style-type: none"> <li>1. <i>Engineers design things</i></li> <li>2. <i>Work with all the people</i></li> <li>3. <i>Build things</i></li> </ol>                                            |
|                          | <ol style="list-style-type: none"> <li>1. <i>I don't know</i></li> <li>2. <i>I don't know</i></li> <li>3. <i>I don't know</i></li> </ol>                                  | <ol style="list-style-type: none"> <li>1. <i>Help people</i></li> <li>2. <i>Make things</i></li> <li>3. <i>Make art</i></li> </ol>                                                                         |
|                          | <ol style="list-style-type: none"> <li>1. <i>I don't know</i></li> <li>2.</li> <li>3.</li> </ol>                                                                          | <ol style="list-style-type: none"> <li>1. <i>Design a lot of things</i></li> <li>2. <i>Build things</i></li> <li>3. <i>Invent things</i></li> </ol>                                                        |
| C                        | <ol style="list-style-type: none"> <li>1. <i>They build technology</i></li> <li>2. <i>IDK</i></li> <li>3. <i>IDK</i></li> </ol>                                           | <ol style="list-style-type: none"> <li>1. <i>Problem solving</i></li> <li>2. <i>Thinking</i></li> <li>3. <i>Teamwork</i></li> </ol>                                                                        |
|                          | <ol style="list-style-type: none"> <li>1. <i>Combierten algo (They transform something)</i></li> <li>2.</li> <li>3.</li> </ol>                                            | <ol style="list-style-type: none"> <li>1. <i>Never give up</i></li> <li>2. <i>Work hard</i></li> <li>3. <i>Learn new things</i></li> </ol>                                                                 |
|                          | <ol style="list-style-type: none"> <li>1. <i>Construllen (They build)</i></li> </ol>                                                                                      | <ol style="list-style-type: none"> <li>1. <i>Actividades (Activities)</i></li> <li>2. <i>Resolver problemas (Solving problems)</i></li> <li>3. <i>Ciencias y matematicas (Science and math)</i></li> </ol> |
|                          | <ol style="list-style-type: none"> <li>1. <i>Projects (zipline)</i></li> <li>2. <i>Study the ocean</i></li> <li>3. <i>I don't know anything else</i></li> </ol>           | <ol style="list-style-type: none"> <li>1. <i>Actividades (Activities)</i></li> <li>2. <i>Ciencias (Science)</i></li> <li>3. <i>Resolver problemas (Solving problems)</i></li> </ol>                        |
|                          | <ol style="list-style-type: none"> <li>1. <i>Build stuff</i></li> <li>2. <i>Use technology</i></li> <li>3.</li> </ol>                                                     | <ol style="list-style-type: none"> <li>1. <i>Help people</i></li> <li>2. <i>Fix things</i></li> <li>3. <i>Make stuff</i></li> </ol>                                                                        |
|                          | <ol style="list-style-type: none"> <li>1. <i>Designing buildings</i></li> <li>2. <i>Creating things</i></li> <li>3.</li> </ol>                                            | <ol style="list-style-type: none"> <li>1. <i>Build things</i></li> <li>2. <i>Math</i></li> <li>3. <i>Science</i></li> </ol>                                                                                |

**Appendix F: Continued**  
**Girls' Responses to: "What are three examples of what engineers do?"**

|   |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                  |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| D | <ol style="list-style-type: none"> <li>1. <i>Build houses</i></li> <li>2. <i>Make blueprints</i></li> <li>3. <i>I don't know</i></li> </ol>                                                                                              | <ol style="list-style-type: none"> <li>1. <i>Make buildings</i></li> <li>2. <i>Create dams, like beavers</i></li> <li>3. <i>IDK (I don't know)</i></li> </ol>                                                    |
|   | <ol style="list-style-type: none"> <li>1. <i>Descubren cosas (Discover things)</i></li> <li>2. <i>Asen cosas (Make things)</i></li> <li>3. <i>Mescla mucho liquids (Mix a lot of liquids)</i></li> </ol>                                 | <ol style="list-style-type: none"> <li>1. <i>Build things</i></li> <li>2. <i>Save water</i></li> <li>3.</li> </ol>                                                                                               |
|   | <ol style="list-style-type: none"> <li>1. <i>Create stuff</i></li> <li>2. <i>Invent things</i></li> <li>3. <i>Have fun</i></li> </ol>                                                                                                    | <ol style="list-style-type: none"> <li>1. <i>Inventan cosas (Invent things)</i></li> <li>2. <i>Trabajan (Work)</i></li> <li>3. <i>Disenar cosas (Design things)</i></li> </ol>                                   |
|   | <ol style="list-style-type: none"> <li>1. <i>Building stuff together</i></li> <li>2. <i>They make things safe</i></li> <li>3. <i>Help people</i></li> </ol>                                                                              | <ol style="list-style-type: none"> <li>1. <i>Work hard</i></li> <li>2. <i>Never give up</i></li> <li>3. <i>Learn how things work</i></li> </ol>                                                                  |
|   | <ol style="list-style-type: none"> <li>1. <i>Ayudar a la comunidad (Help the community)</i></li> <li>2. <i>Crear ideas para mejorar cosas (Come up with ideas to make things better)</i></li> <li>3. <i>Construir (Build)</i></li> </ol> | <ol style="list-style-type: none"> <li>1. <i>Construir cosas y disenar (Build things and design)</i></li> <li>2. <i>Ayudar a la gente (Help people)</i></li> <li>3. <i>Reparar cosas (Fix things)</i></li> </ol> |
|   | <ol style="list-style-type: none"> <li>1. <i>Build stuff</i></li> <li>2. <i>Plan stuff</i></li> <li>3. <i>Technology</i></li> </ol>                                                                                                      | <ol style="list-style-type: none"> <li>1. <i>Trabajar juntos (Work together)</i></li> <li>2. <i>Hacen cosas (Make things)</i></li> <li>3. <i>Son inteligentes (They are smart)</i></li> </ol>                    |
|   | <ol style="list-style-type: none"> <li>1. <i>Solving problems</i></li> <li>2. <i>Helping people</i></li> <li>3. <i>Do math</i></li> </ol>                                                                                                | <ol style="list-style-type: none"> <li>1. <i>Help people</i></li> <li>2. <i>Design things</i></li> <li>3. <i>Write reports</i></li> </ol>                                                                        |
|   | <ol style="list-style-type: none"> <li>1. <i>Help people</i></li> <li>2. <i>Build things</i></li> <li>3. <i>Make things safe</i></li> </ol>                                                                                              | <ol style="list-style-type: none"> <li>1. <i>Dibujos (Drawings)</i></li> <li>2. <i>Usar computadoras (Use computers)</i></li> <li>3. <i>Diseñar cosas (Design things)</i></li> </ol>                             |