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Head Start on Engineering

2017–18 Program Year Evaluation Report

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INTRODUCTION

Head Start on Engineering (HSE) is a multi-component, bilingual (Spanish/English) program model integrated within the Head Start system and designed to spark and sustain interest in engineering for preschool children and their families. HSE fosters connections across preschool and family learning contexts to catalyze long-term, enduring family interests related to science and engineering—sometimes called long-term interest pathways (Pattison et al., 2017). Unlike many other preschool science or engineering programs, HSE focuses on home-based experiences first and then creates complementary classroom activities to support family learning.

The HSE program provides comprehensive services for parents,[1] children, and their teachers, including professional development, hands-on engineering activities for families, parent workshops, preschool classroom curricula, science center field trips to the Oregon Museum of Science and Industry (OMSI), and rigorous assessment and program improvement. In the short term, HSE is designed to:

1) *Develop families' interest in engineering,*
2) *Increase parents' and children's engineering and design thinking skills, and*
3) *Support other early childhood development outcomes, such as numeracy and early reading skills.*

The details of the program model and activities are described in the Program Guide (Pattison, Núñez, et al., 2018) and other project publications (Pattison et al., 2017; Pattison, Weiss, et al., 2018). This report focuses on the evaluation study that was conducted during the 2017–18 pilot program year. The report is written for program managers, researchers, and evaluators interested in evidence of the program's impact on families and staff members, as well as lessons learned that the team is using to strengthen and expand the program moving forward. The report also provides technical details about the evaluation instruments and measures used to assess program impacts.

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[1] Throughout this report, the term "parent" is used broadly to include the central adults and caregivers in a child's life, whether or not they are the biological parents.

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METHODS

The HSE program has been developed over the last five years through an iterative process of piloting, research, and evaluation (Pattison, 2014; Pattison et al., 2017; Pattison, Weiss, et al., 2018; Svarovsky, Pattison, Verbeke, Benne, & Corrie, 2017). During the 2017–18 school year, the team conducted a pre/post evaluation with 28 families and eight teachers and staff members at three different Head Start locations within the Mt. Hood Community College (MHCC) Head Start system.[2] The goal of the evaluation was to assess program impacts on participants, identify possible improvements, and pilot instruments and data collection strategies for studying family interest development related to science and engineering at a broader scale.

Based on the program's approach to family engagement, the evaluation study used a family-level systems perspective to assess program impacts, including changes in engineer-related interested development (Pattison et al., 2016, 2019). In other words, the team conceptualized engagement and interest related to engineering as distributed across the whole family and involving ongoing, reciprocal changes in parents, children, and other family members.

Participants and Recruitment

Head Start teachers recruited families with children ages 3 to 5 to participate in the program through the initial family engineering nights (HSE activity nights hosted at each site at the beginning of the year) and individually using the program flyer developed by the project team (Appendices A and B). Teachers were asked to discuss the program with families that were likely to be able to participate in all program events (e.g., they could participate in evening parent workshops), would enjoy and benefit from the program, and represented the diversity of the MHCC Head Start community, both in terms of languages spoken and racial/ethnic diversity.

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[2] https://www.mhcc.edu/headstart/

A total of 28 families were recruited and completed the pre-program survey (see below). The characteristics of these families are outlined in Table 1. The mean child age across the families was 4.16 years (*SD* = 0.58, Range = 3–5). Separately, a Parent Advisory Council (PAC) of six Head Start parents from the three implementation sites was also organized to provide feedback and guidance throughout the year.

TABLE 1. *Family participant characteristics*

Characteristic	Frequency (*n* = 28)
Child gender	
Girl(s)	39.3%
Boy	57.1%
Both	3.6%
No. of children in program	
One	85.7%
Two	14.3%
Primary language	
English	53.6%
Spanish	39.3%
Both	7.1%

Note. Participant characteristics were provided by Head Start teachers. A few families had two Head Start children participating in the program. Two of these families had two girls and one had a girl and boy (listed as "both" under child gender). Two families reported both Spanish and English as their primary home languages.

Head Start staff member participants included all of the classroom teachers and family works at the three participating MHCC Head Start locations (Fairview, Rockwood, and Troutdale). At the outset, there were three teachers and one family worker at the Fairview location, three teachers and one family worker at Rockwood, and two teachers and one family worker at Troutdale. During the school year, two teachers left and were replaced by two new staff members, only one of whom participated in the HSE program. One family worker also left and was not replaced.

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Data Collection

Evaluation activities were conducted between October 2017, when the first professional development workshop for Head Start teachers and staff members was held, through the end of the school year (May 2018). Primary data collection methods for families included:

- ***Pre- and post-program parent surveys*** to assess awareness and knowledge of the engineering design process, personal interest in engineering, attitudes about the value of engineering in early childhood, confidence supporting engineering interest development, and frequency engaging with HSE and other engineering-related activities (Appendices C–F); and
- ***Post-program parent interviews*** to gather feedback and explore parent perspectives on program impacts (Appendix G).

Primary data collection methods for Head Start teachers and staff members included:

- ***Pre- and post-program surveys*** to assess awareness and knowledge of the engineering design process, personal interest in engineering, attitudes about the value of engineering in early childhood, and confidence supporting engineering interest development (Appendices H and I);
- ***Monthly online journals*** to gather feedback and questions, document teacher and staff engagement with the program, and assess frequency incorporating HSE and other engineering-related activities into classroom and family interactions (Appendix J).

These primary data collection activities were informed by a variety of secondary methods, such as ongoing team reflections, an end-of-year debrief meeting with Head Start teachers, regular input from an advisory council of Head Start parents, and team member observations of program events. The surveys for both parents and teachers also included a number of open-ended questions asking for feedback about the program and the survey itself.

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The parent and teacher post-program surveys were completed approximately one month after the end of the program (i.e., after the end-of-year science center visit). Completion of the parent pre-program survey was part of the recruitment process, so the response rate for this survey was 100%. The response rates for the parent post-program survey and interview were 85.7% and 92.9% respectively. In a few cases, there was confusion about the post-program interview, meaning that parents completed these questions themselves, in addition to the survey questions. This may have been one of the reasons why some parents said that the post-program questions were redundant (see results below).

Evaluation Measures

The pre- and post-program surveys for parents and Head Start staff members included a variety of measures designed to capture a range of engineering-related interest development indicators.

Parent Survey Measures
Table 2 below describes the five multi-item indices included in the parent pre- and post-program surveys. Composite scores for each index were constructed using the mean of all valid responses for each participant. Items were developed based on input from project partners and prior research on engineering-related interest development with Head Start families (Pattison, 2014; Pattison et al., 2016, 2019; Pattison, Weiss, et al., 2018) and drew from several previously developed measures of science and engineering interest (OECD, 2009; Yun, Cardella, Purzer, Hsu, & Chae, 2010). Both the personal engineering interest and value for engineering in early childhood measures included negatively worded items that were reversed coded for analysis.

Similar measures were used on the pre- and post-program surveys with Head Start teachers and staff members, although teachers were not asked about the frequency that they engaged with HSE- and engineering-related activities with their families. Instead, the monthly journal prompts asked about frequency of HSE-related activities in the classroom and with Head

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Start parents and children. The wording for the teacher items was nearly identical. The teacher personal interest measure included a few items that were eliminated from the parent survey for length. Wording for the teacher value and teacher comfort items was modified to reflect the Head Start education context, rather than the family learning context.

TABLE 2. *HSE program evaluation survey measures*

Index name	No. of items	Response scale	Example item
Personal engineering interest	Seven	Five levels, not at all important to very important	*I find that engineering helps me solve problems in my daily life.*
Value for engineering in early childhood	Six	Five levels, not at all important to very important	*Learning engineering skills supports other areas of my child's development.*
Comfort engaging children in engineering	Six	Five levels, not at all important to very important	*I am comfortable doing engineering activities with my child.*
Frequency engaging in HSE activities	Nine	Five levels, never to once a day or more	*Read one of the books from the Head Start on Engineering activity kits.*
Frequency engaging in engineering activities	Ten	Five levels, never to once a day or more	*Use engineering skills when playing with your child.*

Note. The HSE frequency measure was only included on post-program survey.

Table 3 shows the measurement characteristics of the items in the pre- and post-program parent surveys. Most of the survey items appeared to function well. There were no noticeable issues of missing data for specific items or indices. In a few cases, it appeared that parents marked the wrong responses to negatively worded items (i.e., their agreement levels with these items did not match the responses to other items in the set). This was especially true for one of the items in the parent value set: "I would like my child to learn engineering, but the school day is already too full to include this topic." Parents may have been responding to only the first half of the

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phrase. This was true for several teacher respondents, as well. In this case, the item was dropped for subsequent analyses.

TABLE 3. *Parent survey measure characteristics*

Measure	*n*	*M*	*SD*	*α*	Range Potential	Range Actual	Skew	Kurtosis
Pre-program								
Personal interest	28	4.13	0.61	0.84	1 − 5	2.57 − 5.00	-0.36	-0.31
Parent value	28	4.69	0.40	0.91	1 − 5	3.80 − 5.00	-1.03	-0.47
Parent comfort	28	3.83	0.57	0.82	1 − 5	2.67 − 4.83	0.07	-0.57
Eng. frequency	27	2.21	0.75	0.89	1 − 5	1.00 − 3.60	0.06	-0.49
Post-program								
Personal interest	24	4.46	0.51	0.88	1 − 5	3.14 − 5.00	-0.71	-0.25
Parent value	24	4.76	0.34	0.88	1 − 5	4.00 − 5.00	-1.19	-0.14
Parent comfort	24	4.35	0.50	0.83	1 − 5	3.33 − 5.00	-0.23	-0.66
Eng. frequency	24	3.09	0.87	0.95	1 − 5	1.90 − 5.00	0.43	-0.49
HSE frequency	24	3.06	0.79	0.89	1 − 5	1.33 − 4.89	0.40	0.15

Note. Skew and kurtosis are each divided by twice their standard errors. Thus, an absolute value above 1 indicates a statistically significant ($p < 0.05$) deviation from normal, based on the standardized z-score (Field et al., 2012).

Reliability analysis suggested that the internal consistency of the post-program personal value index would be slightly increased by dropping the second negatively worded item ("*My child is too young to learn engineering skills*"). Similarly, the reliability of the pre-program parent comfort index would be slightly increased by dropping one item ("*I have ideas about how to find more engineering information to help my child*") and the reliability of the post-program HSE frequency scale would be slightly increased by dropping one item ("*Talk about the Head Start on Engineering activities or program*"). Because the change in reliability was small, these items were preserved in the analyses in order to maintain consistency across the teacher and parent survey versions and across the pre- and post-program surveys.

Open-Ended Survey Questions
Two open-ended survey questions were used to assess changes in understanding, associations, and relevance related to engineering and the engineering design process for parents and Head Start staff members.

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TABLE. 4. *Engineering definition open-ended question coding*

Code	Definition	Examples
Building/design	Reference to building, designing, making, constructing, development, or inventing, including references to the engineering design cycle or the steps in that process.	*Engineering is to build or design many things.* *La ingeniería es una profesión que se dedica a construir edificios.*
Problem solving	Reference to problem solving, improving, making easier or better, or innovating.	*Engineering is a way to solve certain problems and challenges, like making a spaceship.* *Es buscar la manera práctica de hacer las cosas más fáciles.*
Science/math	Reference to science or mathematics.	*Es una técnica de ampliar los conocimientos científicos.* *Building a design of structures using a mathematical and/or scientific approach.*
Structures/machines	Reference to a structure, building, technology, or machine (including a specific example of one of these categories).	*Aprender cómo construyen puentes, carreteras y ciudades.* *Design, building, use of engines and machines.*
Child learning	Reference to engaging children (including toys) or supporting their learning or development.	*Que son proyectos que uno puede elaborar junto con sus hijos donde uno puede aportar ideas.* *Engineering is a tool to help my child's curiosity and solve real world issues.*
Everyday connection	Reference to everyday application, connection, relevance, or context (including mentions of "everything," "everywhere," and "daily life").	*The process of making things we use in all aspects of life and improving things we use.* *Que es lo que a diario se presenta. Resolviendo problemas dentro de las escuela, casa o trabajo.*

Note. Coded responses to the open-ended question: "If a friend asked you what engineering is, what would you tell them?"

The first question ("If a friend asked you what engineering is, what would you tell them?") was asked at the beginning of both the pre- and post-program surveys and was used to assess changes in the way that

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participants understood engineering and their associations with that word. The second question ("What are ways that you would say engineering relates to your everyday life, if at all?") was also asked on both surveys and was used to assess changes in how participants felt engineering was relevant to their daily lives.

TABLE. 5. *Engineering relevance open-ended question coding*

Code	Definition	Examples
Everyday objects	Reference to object, structure, or technology that is engineered and is part of respondent's life (not counting children's toys).	*Everything we see has had some form of engineering associated with it. Example: cars need engineers to design them.* *Cuando miramos todas las construcciones.*
Everyday problem-solving	Reference to problem solving, repairing, figuring out, planning, or engineering something oneself in everyday contexts. Must refer to one of these verbs, beyond stating everyday actions or activities. Always counts as "everyday activities."	*Siempre hay retos que se presentan en la vida cotidiana.* *Engineering relates to my everyday life by developing solutions and finding ways to make situations easier.*
Everyday activities	Reference to daily or everyday activities. Must refer to actions or activities, beyond naming everyday objects or contexts.	*Cuando hay que hacer proyectos especiales o las labores diarias.* *Housing, driving, tons of activities!*
Child learning	Reference to child activity, toy, or child development. Always counts as "everyday activities."	*Todos los días los hijos están dispuestos a aprender. Como padres podemos usar la ingeniería con nuestros hijos desde haciendo rompecabezas hasta construyendo con bloques.* *Building with Legos.*

Note. Coded responses to the open-ended question: "What are ways that you would say engineering relates to your everyday life, if at all?"

Parent responses to each question were reviewed and coded inductively by the first author. These codes were then applied to the entire data set. Finally, the coding was reviewed by a bilingual member of the program team and codes and code definitions were clarified and updated. The final code definitions are shown in Tables 4 and 5. Because of the low number of

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Head Start teachers and family members that completed the open-ended questions on both the pre- and post-program surveys, these data were not analyzed for this report.

RESULTS

The study results are first described for parent and family participants, followed by Head Start teachers and staff members and feedback from the Parent Advisory Council.

Parent and Family Participants

Table 6 below shows the number of Head Start families that participated in the different program events across the three Head Start locations.

TABLE 6. *Recruited family participation rates, by location*

	Frequency (%)			
	Rockwood	*Fairview*	*Troutdale*	*Total*
Enrolled	12 (100%)	8 (100%)	8 (100%)	28 (100%)
Family engineering night	--	3 (37.5%)	4 (50%)	--
Parent workshop #1	9 (75%)	4 (50%)	4 (50%)	17 (60.7%)
Parent workshop #2	6 (50%)	5 (62.5%)	5 (62.5%)	16 (57.1%)
Parent workshop #3	4 (33.3%)	1 (12.5%)	7 (87.5%)	12 (42.9%)
Science center field trip	8 (66.7%)	6 (75%)	6 (75%)	20 (71.4%)

Note. Percentages calculated out of total number of families enrolled in program (i.e., completed the pre-program survey before the first parent workshop). Attendance data was missing for the Rockwood family engineering night. Science center field trip attendance numbers exclude those who did not complete the post-program survey, although a few of these families may have participated in the field trip.

Attendance was a challenge for the parent workshops, ranging between 12.5% and 87.5%. Factors that may have made attendance challenging included weather, last-minute rescheduling, issues communicating with families and providing reminders, asking families to attend events at different locations besides their primary Head Start location, and working with locations that were managed by staff members not part of the HSE team. All families were provided the take-home activity kits even if they were not able to attend the workshops. Tracking attendance was also a challenge during several of the events, including the family engineering

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nights and the science center field trip. Based on the limited data, it seems that only a few of the families that ultimately participated in the program attended the initial family engineering night.

The next table (Table 7) shows the mean pre- and post-program scores for the primary outcome measures assessed through the parent survey. There were large, positive changes for personal interest, parent comfort, and engineering frequency. Parent value was high at the beginning of the program and remained relatively stable. Although there was no pre-program score for HSE frequency, the post-program data indicated that one month after the last parent workshop families were engaging with HSE activities and materials several times per month on average. The pre-program scores were relatively high for the interest, value, and comfort measures, perhaps indicating social desirability bias.

TABLE 7. *Pre- and post-program score comparisons for parents*

	Pre		Post				
Variable	*M*	*SD*	*M*	*SD*	*t* (df)	*p*	*r*
Personal interest	4.13	0.61	4.46	0.51	2.71 (23)	0.012	0.49
Parent value	4.69	0.40	4.76	0.34	0.13 (23)	0.897	0.03
Parent comfort	3.83	0.57	4.35	0.50	4.01 (23)	<0.001	0.64
Eng. frequency	2.21	0.75	3.09	0.87	4.01 (22)	<0.001	0.65
HSE Frequency	--	--	3.06	0.79	--	--	--

Note. Correlation coefficient (*r*) provided as an effect size (Field et al., 2012). For this coefficient, 0.1 represents a small effect, 0.3 a medium effect, and 0.5 a large effect.

The results for the outcome measures assessed through the open-ended survey questions are shown in Table 8. Overall, there were substantial shifts in how parents defined engineering and the ways they felt it was relevant to everyday life. In the pre-program survey, parents were more likely to associate engineering with building, design, structures, machines, science, and math. On the post-program survey, they were more likely to

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make associations with problem-solving and everyday connections. These changes were large and statistically significant. Similarly, between the pre- and post-program surveys, the percentage of parents that felt engineering was relevant to everyday problem-solving and activities increased significantly, although the change for everyday problem-solving only approached statistical significance.

TABLE 8. *Pre- and post-program coding for parents*

Codes	Pre-program	Post-program	χ^2 (df)	p	h
Eng. definition	(n = 27)	(n = 24)			
Building/design	81.5%	50.0%	5.67 (1)	0.017	0.68
Problem solving	22.2%	58.3%	6.95 (1)	0.008	0.76
Science/math	33.3%	8.3%	4.69 (1)	0.030	0.65
Structures/machines	44.4%	8.3%	8.32 (1)	0.004	0.87
Child learning	14.8%	8.3%	0.51 (1)	0.473	0.20
Everyday connection	11.1%	50.0%	9.26 (1)	0.002	0.89
Eng. relevance	(n = 26)	(n = 23)			
Everyday objects	43.3%	26.1%	1.42 (1)	0.234	0.34
Problem-solving	26.9%	52.2%	3.28 (1)	0.070	0.52
Everyday activities	50.0%	87.0%	7.58 (1)	0.006	0.83
Child learning	15.4%	21.7%	0.33 (1)	0.566	0.16

Note. Responses could be coded into multiple categories; therefore, totals exceed 100%. The effect size *h* is used for the difference between two proportions. A value near 0.2 is a small effect, near 0.5 is a medium effect, near 0.8 is a large effect (Cohen, 1988).

On the post-program survey, parents were also asked to indicate how likely they were to recommend the program to other Head Start families. As shown in Table 9, almost every family said they were likely or very likely to recommend the program. Based on other responses in the survey, the one

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parent who marked "not at all likely" may have confused the direction of the response scale.

TABLE 9. *Frequency of likeliness to recommend program*

Response	Valid % (n = 24)
Very likely	79.2%
Likely	16.7%
In the middle	0.0%
Not very likely	0.0%
Not at all likely	4.2%

Note. Percentages are out of the total, non-missing responses. Based on other responses in the survey, the one parent who marked "not at all likely" may have confused the direction of the response scale.

Survey Feedback

When asked about other ways they think engineering is valuable for themselves and their children and other things they do related to engineering, parents provided a number of examples that could be used to align program and family goals, as well as expand the existing survey index. In addition to the existing items, parents reported that engineering is valuable for young children because it supports:

- *Motivation* (e.g., "*En querer hacer algo con la intención de que salga lo mejor posible y conseguir ideas del punto de vista de cada uno*");
- *Problem-solving* (e.g., "*I believe it helps with problem-solving skills and allows the child to use and create all the ideas in their head*"; "*I believe it will really create a problem-solving mindset he will have for life*");
- *Creativity* (e.g., "*Makes us use our brains and imagination*"; "*Help my child be a creative thinker*"; "*Help to expand your ideas and put them to life*");
- *Confidence* (e.g., "*Porque le puedo demostrar que nosotros tenemos la capacidad de crear algo*");
- *Communication* (e.g., "*A socializar con otros niños y otras personas adultas*");
- *Empowerment and agency* (e.g., "*Opening the curiosity and willingness to resolve real life issues*"; "*Help to expand your ideas and put them to life*");
- *Spending family time together* (e.g., "*Nos ayuda a pasar tiempo juntos y divertirnos*"; "*It creates quality time for parents and children*");

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- **Understanding how things work** (e.g., *"He can learn how and why things work and don't work"*); and
- **Improved life in general** (e.g., *"Para mejorar todas las cosas de la vida diaria"; "If something is not up to a standard of his liking, he can engineer a better design, product, tool"*).

In addition to the engineering frequency items on the survey, parents also shared a number of ways that they felt they engage in engineering with their children, such as:

- **Using building toys like Legos** (e.g., *"He builds objects with magnetic tiles and blocks"; "Jugar con Legos"; "Every time we play with Legos, we always talk about what we are engineering"; "Put together puzzles and game pieces"*);
- **Building other types of structures** (e.g., *"Ellas siempre andan construyendo casitas para jugar o arman sus juguetes; "We built a new bed frame and built dog kennel"; "Hacer algo para guardar sus libros y colores"*);
- **Cooking and gardening** (e.g., *"Cooking"; "Baking"; "Cook, garden, planting seeds"*).
- **Improving daily tasks and systems** (e.g., *"Trato de que encuentre maneras fáciles de ayudarse"; "Cleaning/organizing kid's room"; "We organize our stroller carrying all our park-related things plus both kiddos so we can get there safely without anything or anyone falling"*); and
- **Thinking about how things are made** (e.g., *"I see my kids looking at what holds things together, and they often ask how it's made"*).

Parents provided a variety of feedback and suggestions in their responses to the additional open-ended questions at the end of the survey. When asked before the program about ways to improve the survey itself, a few parents had suggestions, particularly about terminology and their understanding of the word engineering:

- *La palabra "ingeniería" fue confusa, para el tema que se está tratando.*
- *A better description of examples of engineering activities or less use of the word engineering.*
- *Usar vocabulario menos complejo.*
- *Que expliquen el concepto de ingeniería.*

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- *Yo nunca he hablado sobre el tema de ingeniería con mi hijo así que creo que es algo que debo aprender yo para poder transmitírselo a él.*
- *Not that I can think of other than asking about family members who are engineers. I believe some traits of gifted engineers are genetic.*
- *You could add an "I'm not sure/I don't know" response.*
- *I leave blank spaces because maybe I do not understand the definition of engineering well.*

Terminology did not come up as an issue in the post-program survey. Two parents said there was some redundancy between questions in the post-program survey and the post-program interview.

Parents primarily used the final open-ended question in both the pre- and post-program surveys ("Anything else you'd like to share with the Head Start on Engineering project team?") to express their gratitude for the project and the opportunity to learn new things. For example:

- *I hope to become more knowledgeable in engineering myself so that I may find/create ways to share with my son by participating in this program.*
- *Gracias al conocimiento de la ingeniería hemos estado aprendiendo mucho y sabemos que todos somos ingenieros desde los más chiquitos de la casa hasta los más grandes.*
- *I really appreciate this project because I am learning and so are the girls but I will be able to do more with engineering with them once I learn more. Thank you.*
- *Solamente agradecerles por su tiempo y entrega de enseñar a los padres, que somos los fundamentos de que los niños se motiven y se relacionen en las actividades de ingeniería. Gracias por hacer un duro trabajo con tantos niños en las escuelas. Muchas gracias por su ayuda y apoyo. Fue para mí un aprendizaje ya que mi hijo sea de Head Start.*

A few parents had more specific suggestions related to the program or family recruitment:

- *Una sugerencia, si pueden invitar a las personas personalmente porque muchas de ellas piensan que es algo complicado involucrarse en este tipo de proyectos.*
- *Me gustaría que en el futuro llamaran unos días antes para decirnos cuándo es la junta y no de un momento a otro.*

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- *Maybe more in-class activities. I never heard about anything like that being done from my child's teacher.*
- *Estaría bien involucrar a los niños en las reuniones de ingeniería para así convivir más con ellos.*

Interview Feedback

During the post-program interviews conducted by Head Start staff, parents provided feedback on the pilot videos,[3] shared ideas for improving the program in general, and described ways they thought the program was successful for them and their children.

Of the parents that completed the post-program interview, *12 indicated that they had watched the videos at home and 11 indicated that they had not.* Of those that had, many said that they were helpful for explaining the activities, providing different ideas for how to use the kits, motivating engagement for their children, demonstrating the activities for parents that could not attend the workshops, and providing visual examples of what children were learning. Of the parents that did not watch the videos at home, three indicated they had not received them and two said that even though they did not watch them at home the videos were helpful during the workshops.

More generally, parents had suggestions for improving the program in the future. Ideas mentioned by four or five parents included:

- Having more workshop sessions during the year,
- Including children in some of the workshops, and
- Providing more kits or activity ideas.

Ideas mentioned by two or three parents included:

- Adding more hands-on time during the workshops,
- Making more time for parents to share stories and pictures of what they were doing at home during the workshops,

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[3] During the 2017–18 program year, the team piloted two online videos to support the HSE family take-home activities. The bilingual videos (English audio, Spanish subtitles) demonstrated how to use the activities and showed examples of a project team member facilitating the activities with different families.

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- Lengthening the workshops, and
- Providing a better calendar of dates and more workshop reminders.

Ideas mentioned by only one parent included: clarifying the goal of the Mouse Run activity, providing a clearer explanation of the program before the first workshop, scheduling time for parents to do the activities in their children's classrooms, providing a simpler explanation of engineering, improving the production of the videos, scheduling check-in calls with families, starting the program earlier in the year (and during the winter, when there is less to do outside), expanding the program to include more families, and scheduling more home visits throughout the year. When asked about helping to connect the program and activities to family cultures and experiences, parents mentioned engaging parents in helping to brainstorm connections, having children bring things to share from home that they have engineered, and connecting with *Día de los muertos* or *Día de los niños*.

Parents had several ideas for helping to improve attendance at the evening workshops, including:

- Sending more reminders (including text messages) and reminding parents before the day of the workshop,
- Offering more workshop dates and times for parents to choose from,
- Asking parents at the beginning of the year what times and dates work for them,
- Asking parents what they feel is important to focus on during the program,
- Reminding parents that if needed a different adult family member can attend one of the workshops (e.g., spouses trading nights),
- Involving children in the workshops,
- Providing transportation, and
- Recruiting parents that are committed to being involved.

Parents provided a number of positive quotes about the program when talking about the overall experience, highlighting program successes, and

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sharing ways the program had changed them and their families.[4] For example:

- *We enjoyed all of the projects.*
- *Me gustó mucho y aprendí muchas cosas.*
- *I enjoyed participating in the activities at the meetings and at home, also learning some of the principles of engineering.*
- *Thank you so much for providing dinner, childcare, and transportation. Overall, it was a fantastic experience.*
- *Más que preguntas es agradecimiento por darnos la oportunidad de participar y aprender algo nuevo que va a beneficiar a nuestros hijos en su desarrollo y aprendizaje.*

When asked about the most successful aspects of the program, parents mentioned (in order of frequency):

- ***Supporting their children's interests, engagement, and learning*** (seven parents);
- ***Hands-on activities and kits*** (five parents),
- ***The science center trip*** (four parents),
- ***Using the engineering design process or learning about engineering*** (four parents),
- ***Spending time together*** (three parents),
- ***Building things*** (two parents), and
- ***The books*** (one parent).

When asked about ways the program supported positive changes for parents and their children, common responses included (in order of frequency):

- ***Helping parents and children learn and spend more time together*** (seven parents),
- ***Helping families improve and learn new approaches to problem-solving*** (six parents),

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[4] Quotes are taken from Head Start staff member conversation notes. The interviews were not audio recorded.

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- ***Providing activities and ideas for families to create new activities*** (four parents), and
- ***Learning more about engineering*** (four parents).

Other positive changes mentioned by individual parents included engaging children, learning something new, improving parent patience and understanding of their child, supporting imaginative play, providing an alternative to TV, and supporting other aspects of child development. For example:

- *Ahora él está más interesado en resolver problemas.*
- *Teaching him something new he didn't know but was constantly doing daily.*
- *A no darse por vencido, a intentar las cosas de nuevo y tratar de hacerlo todavía mejor.*
- *Mom has been more understanding of the things child is doing. For example: When mom sees a "mess" child sees engineering, he is building something.*
- *Compartimos más tiempo juntos. Compartir ideas. Usar más su imaginación en vez de estar viendo tele.*
- *That my child tries different ways to resolve before she gives up and complains.*
- *Pasar más tiempo con mi hija. También que mi hija después le enseñaba a su papá cómo hacer la actividad.*
- *It made us spend more time together. Also let us see the different ways to learn how to achieve in the activities together.*
- *Helped family look at engineering differently.*
- *The program gave the family a different perspective and more ideas on how to become involved in activities that were both fun and informative.*
- *The positive thing is there is always a solution. There is not just one way to solve a problem.*
- *Child is listening better, more talkative and trying hard to learn.*
- *Problem solving is always beneficial for this age. Introducing engineering early on supports critical thinking.*

Head Start Staff Members

Teachers and family workers at the three MHCC Head Start locations completed a pre-program survey at the beginning of the first professional

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development workshop, a post-program survey before the final reflection meeting at the end of May, and monthly online journals from December through May. During the school year, two teachers left and were replaced by two new teachers, only one of whom participated in the HSE program. One-family worker also left and was not replaced. Findings should be interpreted cautiously, therefore, since only six staff members completed both the pre- and post-program surveys.

Pre- and post-program composite scores for the survey measures are shown in Table 10. Staff reported high personal interest in engineering and value for engineering in early childhood at the beginning of the program, possibly because they had already heard about HSE before the first professional development workshop and because three of the teachers and two of the family workers had participated in the project previously. In the post-program surveys, average scores for personal interest and confidence both increased. Value for engineering in early childhood decreased very slightly. Reported HSE- and engineering-related activity frequency increased from December through May.

TABLE 10. *Pre- and post-program score comparison for staff*

Variable	Pre		Post				
	M	*SD*	*M*	*SD*	*t* (df)	*p*	*r*
Personal interest	4.28	0.68	4.58	0.35	0.97 (4)	0.386	0.44
Child value	4.85	0.16	4.75	0.19	0.50 (4)	0.641	0.24
Staff comfort	3.43	0.99	4.12	0.34	1.81 (4)	0.145	0.67
Activity frequency	1.73	0.33	2.43	0.49	3.12 (6)	0.021	0.79

Note. Correlation coefficient (*r*) provided as an effect size (Field et al., 2012). For this effect size, 0.1 represents a small effect, 0.3 a medium effect, and 0.5 a large effect. Activity frequency comparison shows the frequency composite in December ("pre") and May ("post").

The effect sizes for the differences between pre- and post-program scores ranged from medium to large. However, only for activity frequency was the sample size large enough for the difference to be statistically significant.

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Head Start staff members responded to the same open-ended survey questions as the parents about the definition and relevance of engineering. However, the team chose not to analyze these responses because of the small sample size, teacher turnover, and missing data issues. In total, only five teachers completed responses for these questions on both the pre- and post-program surveys.

Survey Feedback

When asked to share other ways that they felt engineering is valuable for Head Start parents and children, staff discussed the value for everyday problem-solving and ways of thinking, encouraging parents and children to spend time together, and supporting other areas of child development. Examples related to *everyday problem-solving and ways of thinking* included:

- *Engineering can help families by teaching them to problem solve in creative ways. It gives them the power to create.*
- *I think it is helpful for anyone to understand the engineering process, and it can be applied to many areas of life and everyday problems.*
- *Being able to solve a problem will build self-esteem.*
- *Helps teach children how to assess and develop plans to resolve problems, useful in school and career.*
- *This gives us a way of having an open mind and thinking outside the box. For me and my family, it's always helpful to think about different options.*
- *Engineering expands the way families think about a situation. This can over flow into other problem-solving areas.*
- *It encourages them to think in new ways. It opens a door of possibility that they may not have realized before.*

Examples of comments related to *parents and children working together* included:

- *...Building cohesiveness while working together on projects.*
- *To spend time together... Share ideas.*
- *... and ways to help each other*
- *It helps them to work as a team.*

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Examples of comments related to ***other areas of child development*** included:

- *Engineering activities also work on the other academic skills.*
- *Being able to solve a problem will build self-esteem.*
- *Child development/imagination/vocabulary.*
- *I think it is valuable in everybody's lives, and head start families in building their children's personality and future.*
- *Engineering helps children and their families apply math skills.*
- *It includes all academic skills in a wholistic and meaningful way.*
- *Kids are exploring new things. It builds confidence/thinking skills.*
- *I think this age is good for hands-on material, to explore and test.*
- *I think it opens the doors for Head Start families to participate in activities that they would maybe not be exposed to.*

Staff Journals

In the monthly online journals, participating Head Start teachers and family workers (a) described the ways they had engaged with children and families related to the HSE program that month and (b) reported the frequency that they had engaged in a variety of HSE- and engineering-related activities during that time period.

Based on the composite score (average across all of the frequency items), staff engagement in HSE- and engineering-related activities increased over the six months, from between never and less than once a month on average in December to between less than once a month and several times a month in May (Table 11). Frequency of talking to staff and families appeared to match the recruitment and data collection schedule, with higher frequencies at the beginning and end of the program. Frequency of use of the take-home activities mirrored the timing of when the activities were introduced in the parent workshops and shared with teachers to use in their classrooms (e.g., the Fox and Hen activity was introduced and began to be used by teachers in February and was heavily used in March).

The frequency of teachers and family workers reading the HSE books, using the word engineering, finding new uses for the HSE activities and materials, creating new activities and challenges, and incorporating the engineering design process into other classroom experiences all steadily increased over the year.

Table 11. *Avg. monthly frequency of staff engineering activities*

Activity	Month					
	Dec.	**Jan.**	**Feb.**	**March**	**April**	**May**
Talk to staff	3.40	3.10	3.00	2.89	3.13	3.38
Talk to families	3.10	3.00	3.00	2.89	3.00	3.25
Fox and Hen	1.00	1.10	1.70	2.44	1.75	1.75
Mouse Run	1.00	1.00	1.00	1.00	2.00	1.75
Bubble Wands	1.00	1.00	1.00	1.00	1.75	2.13
Bird Nests	1.00	1.00	1.00	1.00	1.38	1.75
Activities with families	1.00	1.10	1.40	1.89	1.43	1.38
Read books	1.00	1.30	1.60	2.56	2.63	2.63
Say engineering	2.70	2.80	3.00	2.89	3.00	3.38
Find new uses	1.60	1.20	1.20	2.11	2.50	2.25
Create new activities	1.90	1.70	2.00	2.00	2.38	2.13
Incorporate eng. Process	2.10	2.00	2.20	2.44	2.63	3.38
Composite	*1.73*	*1.69*	*1.84*	*2.09*	*2.30*	*2.43*
Composite (teachers)	*1.81*	*1.81*	*1.92*	*2.28*	*2.45*	*2.53*

Note. Response values: 1= never, 2 = once a month or less, 3 = several times a month, 4 = several times a week, 5 = once a day or more. The composite was calculated as the mean for all engineering activity item frequency scores. Although family workers reported engaging in a variety of HSE- and engineering-related activities, average frequencies were generally higher for teachers, as shown in the composite score for teachers only.

The most general engineering-related behaviors (using the word engineering and incorporating the engineering design process) were the most frequent activities reported by teachers by the end of the year, falling

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between several times a month and several times a week. The frequency data highlight the potential for introducing the activities earlier in the school year, so that teachers have more time to integrate them into the classroom.

Through the journals, staff members shared examples of ways they had incorporated the HSE program into their work. For example:

- *We did our first activity in March. I introduced it at large group. We read the book as a large group and talked about the problem that was occurring in the story. I asked children what they thought might help the chicken be safe and a few friends came up with the solution of building a fence. During the week we worked together as a small group. I encouraged friends to work together to help solve the problem.*

- *The first day of reading the book we provided children with the foam shapes and the fox picture and asked them to build a house for the hens to protect them. Children were building and measuring and talking. One child made a house with a tunnel but then he realized it will be easy for the fox to go in so she decided to make the same idea saying that the fox couldn't climb. The second time we added the shaving cream and children enjoyed this idea.*

- *Another teacher and I both decided to branch off with the three little pigs story to study engineering. I had been telling the story for several months so the children would be familiar with the story. I would talk to the children about firm foundations, what makes a house stable, and on our weekly walks we would look at our building to see examples of pillars as support and the roof that protects the building. The other teacher and I both did an activity of giving the children shapes to build the three little pigs' homes. I gave children a choice of which home they wanted to build: a house made out of straw, a house made out of sticks, or a house made out of bricks. Some children decided to do all three.*

- *We had our parent night at OMSI. It was a huge success, and all our families had fun! It was a good turnout. I also was able to do the second project in the class. I read the book about the cat and the mouse to the large group and then did the activity with the small group. We had a great conversation about what would work. First the children started with a straight line down. Once we experimented with it, they decided to "just start over." They decided to use the tubes in a zig zag formation which was a lot more successful.*

- *This month we tried two different activities in class (making the baby nest and making bubbles). First, I read the book in a large group. Children really enjoyed*

the books for both activities. Then we set a table with materials for children to use. They really liked the bubbles activity, and they were able to make the bubbles wands with the pipe cleaner. They also used the straw to blow bubbles. And for the baby nest it was easy for them to make the nest on top of the bowl. Making the nest on the cups was kind of hard so they used the sticks on the cup and tried to make the nest on the sticks.

Head Start teachers and staff members also shared their perspectives on how the program had impacted them and the Head Start community. For example:

- *I've really enjoyed being part of this program for another year. All the families have expressed gratitude for the program and have felt that they learned a lot from it. We all hope the program will continue to grow and offer support and amazing experiences for families in the future.*
- *Families seem to be much more comfortable with engineering as a concept and understand what part it plays in their daily lives.*
- *At the home visits; I was able to talk to parents about the trip to OMSI and how it relates to engineering. Parents were able to give more details about how they now see engineering versus what they thought engineering was before.*
- *I enjoyed working with all of you this year. I also learned a lot from you. All the books and activities were so useful to use in class, and children and families liked the activities.*
- *I really enjoying being with this program. The program had great ideas for children this age. I like how we read a book and add an activity to it—that helps to retell and talk about the book.*
- *During home visits, I talked to the families about the "Oh No! A Fox!" activity and asked if there were any comments. One family said that her son was spending more time doing the building than watching TV. This made her very happy.*

Final Head Start Staff Reflection Meeting
On May 29, 2018, members of the project team met with Head Start teachers and family workers from the participating Head Start locations to debrief about the program year and plan for the future. All of the staff members that were still with the program at that time were able to attend the meeting.

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Head Start staff members felt that many of the program events and components had been successful and should continue as part of the program moving forward. These included:

- **The take-home activity kits**, including the engineering design cycle overview sheet;
- **The children's books** included with each kit, which made the activities more meaningful and promoted literacy practices (although some of the books may have been too wordy for families);
- **The parent workshops**, which provided adult-only learning time and seemed to make a difference for those who were able to attend;
- **Opportunities for fathers** to be involved in the program, such as attending the evening workshops or using the take-home activity kits;
- **The science center visit**, which was extremely well attended;
- **The bilingual sessions** and quality bilingual materials, which made families feel welcome;
- **The final parent interviews**, which allowed for more in-depth feedback (although it was difficult for staff members to complete all the participant interviews);
- **Transportation, dinner, and childcare** provided for families;
- **Connections** between the take-home kits and classroom experiences; and
- **The pilot activity kit videos** (although not all families received or used them)

Staff members also highlighted several challenges and ideas for improvement:

- **Explore strategies for increasing attendance at the parent workshops**, such as providing more reminders with phone calls and texts, providing a workshop calendar and sending calendar invites, offering prizes for participants who attend, using locations that families are familiar with, providing clear and more compelling advertising about the content of the workshops, avoiding last-minute meeting changes, building in other incentives for attendance and participation, asking families about availability before scheduling, and recognizing the high turnover rate of Head Start participants.
- **Improve logistics and orientation for families during the science center visit**, including dinner logistics and regulating the number of families in the early childhood space.

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- ***Provide more suggestions for how teachers can adapt the activity kits*** to the classroom, such as using the activities with larger groups of children, and consider the possibility of coaches to support classroom teachers.
- ***Avoid scheduling too many program and data collection activities during the last month*** **of the year** and lower the overall burden for families (e.g., completing both post-program surveys and interviews is hard).
- ***Explore other staff communication strategies*** besides the "PD contacts," which was only moderately successful, and consider creating a program event and meeting calendar for staff. [5]
- ***Provide more time in between the workshops*** for families to use activity kits and teachers to introduce the activities in the classroom, perhaps by starting earlier in the year.
- ***Experiment with different attachment systems for the Mouse Run activity***, such as Velcro, or consider creating a separate classroom version without tape.
- ***Consider ways to help kids who have trouble making the bubble wands*** with the pipe cleaners (because of different levels of fine motor skills).

Other ideas raised during the discussion included: providing more PD related to engineering for teachers and staff members, exploring different types and applications of engineering (e.g., chemical engineering), using the "social stories" format to better explain the engineering design process to families and children, and continuing to expand the program with more extension ideas and more activities based on books that teachers and families already use.

Parent Advisory Council

A Parent Advisory Council (PAC) of Head Start parents was organized at the beginning of the school year to provide feedback and guidance to project team throughout the year. A total of six parents agreed to be part of the group (two families from each of the three HSE implementation sites), including some parents who had participated in HSE the previous year and some who had been recruited to participate during the current year. The

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[5] During the 2017–18 program year, one Head Start teacher at each implementation site was nominated to be the "Professional Development contact" person and help facilitate communication between other staff at their location and the larger HSE project team.

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PAC met three times throughout the year: once in February after the family engineering night but before the first parent workshop, once in March after the first and second parent workshops, and once in May after the science center visit. Attendance at the PAC meetings was variable, similar to the parent workshops. There were six parents at the first meeting, four at the second, and three at the third.

Several themes and recommendations emerged from the discussions with the PAC:

- ***Important roles for the PAC include*** identifying strategies for getting more parents involved in the HSE program, helping to make the engineering focus more inviting and accessible, gathering parent input on program and research components, brainstorming new activity and program ideas, and strengthening connections between the classroom and home.

- ***Engineering is a big word*** and is likely intimidating for many families. The team should more clearly advertise ways that the program will provide activities for parents and children to do together that support children's learning and development. Other ideas included more clearly connecting the program to the Oregon Museum of Science and Industry, providing more explanation about what parents and kids will do during the workshops, explaining the importance and relevance of engineering, and getting help from parents in designing advertising materials.

- ***The parent workshops and take-home activities were enjoyable and successful***. The science center visit was also a highlight for many families.

- ***The parent workshops could be longer*** to provide enough time for all the activities and topics.

- ***The survey questions were repetitive and somewhat confusing***, according to a few parents.

- ***Not all of the families received the pilot videos***, and there was considerable variability across families in terms of who used them.

- ***The team should consider strategies for improving dinner logistics and family orientation*** during the science center visit. Transportation did work better than last year.

- ***Ideas for increasing parent attendance***, including avoiding last-minute date and time changes, reminding families in advance (using text messages directly to families, rather than through teachers), and reserving an extra workshop day in case of weather cancellations.

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DISCUSSION AND RECOMMENDATIONS

During the 2017–18 school year, evaluation activities with family participants included pre- and post-program parent surveys and a post-program parent interview conducted by Head Start family workers. Evaluation activities with Head Start staff participants included pre- and post-program surveys, monthly online teacher journals, and an end-of-year group reflection meeting. A Parent Advisory Council was organized at the beginning of the year, with two families recruited from each of the three participating Head Start locations. The group met three times before, during, and after the program to provide input and feedback. Throughout the process, the HSE project team regularly reviewed feedback, made ongoing changes, and identified lessons learned for the future.

Key findings from evaluation activities with family participants included:

- ***Parents reported higher levels of personal interest in engineering and comfort supporting their children's engineering interests*** compared to responses in the pre-program survey. These changes were large and statistically significant. Parent value for engineering in early childhood was high at the outset and remained relatively stable.

- ***Parents reported engaging with engineering-related activities with their children and families more frequently*** compared to responses in the pre-program survey. These changes were large and statistically significant. For example, parents reported talking with their children about engineering, finding examples of engineering in everyday life, and using engineering skills when playing with their children between several times a month and several times a week on average at the end of the program.

- ***One month after the last parent workshop, parents reported regularly engaging with the HSE activities, books, and materials with their children.*** For example, parents reported talking with their children about the HSE program, using the HSE activity kits, and reading the HSE books between several times a month and several times a week on average at the end of the program.

- ***Parents demonstrated expanded understandings of engineering and its relevance to everyday life.*** In the pre-program survey, parents often described engineering as related to building, design, structures, and machines. In the post-program survey, parents were much more likely to describe engineering

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as related to problem-solving in everyday contexts. Parents were also much more likely to see engineering as relevant to everyday activities in the post-program survey. These changes were large and statistically significant.

- ***Parents strongly recommended the program.*** Every parent participant but one that completed the post-program survey indicated they would be likely or very likely to recommend the program to other Head Start families.

- ***Parents saw broad value in the program beyond engineering.*** When asked in the interviews about ways the program supported positive changes for parents and their children, common responses included: helping parents and children spend more time and learn together, helping families develop new approaches to problem-solving, and providing new activity ideas for families.

Key findings from evaluation activities with Head Start staff members included:

- ***Head Start staff members reported higher levels of personal interest in engineering and confidence in engaging Head Start children and families in engineering.*** These changes were large in magnitude. However, because of the small sample size the differences were not statistically significant. Value for engineering in early childhood was high at the outset and remained relatively stable, similar to results for parents.

- ***Head Start staff members increased the frequency that they engaged with engineering-related activities with children and families.*** This change was large and statistically significant. For example, during the last month of the school year teachers and family members reported talking to families about engineering, using the words "engineer" and "engineering" with children and parents, and incorporating the engineering design process into other activities between several times a month and several times a week on average.

- ***Head Start staff members saw broad value in the program beyond engineering.*** In discussing other ways that they felt engineering is valuable for Head Start families and children, staff members emphasized everyday problem-solving and ways of thinking, parents and children working together, and other domains of early childhood development.

Program Recommendations

Based on feedback, team reflections, and evaluation findings, there are several lessons learned that the team will be using to make improvements to the program in the coming years:

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- ***Increasing workshop attendance rates***—Almost all families reported that the parent workshops were a valuable part of the program. However, for variety of reasons parents were often not able to attend all of the workshops throughout the year. Participation ranged from 13% to 88% at the different workshops and different sites. Even though all participants received the take-home activity kits, those who could not attend did miss out on valuable support for engaging their families in engineering. In the surveys, post-program interviews, and Parent Advisory Council meetings, participants offered a number of suggestions for supporting better workshop attendance, including more frequent text message reminders, back-up workshop dates in case of weather cancellations, and holding workshops at sites that parents are familiar with rather than combining sites. It may also be important to work with locations that are overseen by site managers who are part of the HSE program team.

- ***Including parent-child interaction components in the parent workshops***—An important goal of the parent workshops is to provide parents time to engage with engineering themselves as learners before trying to support their children. This was indeed a valuable aspect of the program for participants. However, parents also requested some time during the workshops to work directly with their children while program staff are present. In coming years, the team hopes to extend the length of the evening workshops and incorporate parent-child interactions segments in addition to the parent-only segments.

- ***Broadening the appeal and accessibility of the program***—Members of the Parent Advisory Council emphasized that the program is extremely valuable for families but that the word engineering may be intimidating to many parents. They recommended improving the way the program is advertised to families and emphasizing problem-solving skills and fun activities for parents and children. Similarly, parents and teachers suggested ways to make the explanations of the engineering design process more accessible, such as using a "social stories" book approach with text and images associated with each step. Previous program years have also demonstrated the power of using the name and brand of the Oregon Museum of Science and Industry (OMSI) to recruit participants and improve attendance at program events.

The team is also considering a number of other improvements to the program based on feedback and evaluation findings: producing videos for all the take-home activities and finding better systems for ensuring that all the families receive and can access the videos; increasing the length of the evening parent workshops, as requested by families; streamlining the communication systems with both teachers and families, such as using text

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messages and the Head Start electronic communication system; providing more activity ideas, resources, and extensions, as requested by families; helping teachers with ideas and strategies for adapting the take-home kits for the classroom, since Head Start staff have very little time for lesson planning; providing ideas for adapting the activities to younger children (both at home and in the classroom); and shifting the program start date to earlier in the year to give families and teachers more time to try out the activities and receive support from program staff.

More broadly, the experience with families and the Head Start community over the last year has inspired a number of other potential new directions for the HSE program, such as:

- ***More explicitly aligning HSE to support other family and child development goals***, including both education learning goals identified in the Head Start program and unique goals identified by individual families. For example, the HSE program could be integrated into the "family partnership agreement" process that Head Start teachers and family workers use to help families set goals for themselves and their children. The program can also be used to empower parents in other ways, including creating leadership opportunities and allowing parents to become more involved in the research and assessment process. Reflections by parents in the surveys and interviews showed evidence of ways that these participants were building skills observing their children, understanding development, and responding to their children's learning. Helping parents and children spend more time learning together is also a key goal of the Head Start program that aligns well with the HSE program model and was highlighted by parents in the interviews.

- ***Continuing to improve systems and logistics related to program communication and coordination.*** This year, program implementation highlighted the importance of the site manager and specific teacher champions for helping to ensure the success of the program, recruit and retain family participants, manage communication between the project team and Head Start staff members, and motivate other Head Start teachers and family workers to be involved. Having site managers that are bought into the program and can be on site to work with staff and families may be critical for success. For teachers, regular check-in meetings could be integrated into monthly teacher meetings or other existing staff structures.

- ***Exploring approaches to supporting returning families and staff members that have participated previously in HSE.*** This includes

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talking to returning families to gather ongoing feedback to inform program improvements, creating programs and professional development experiences that work for both new and returning participants, identifying aspects of the program and activities that families can build on and expand, and leveraging the opportunity afforded by repeat participation to promote staff and parent leadership.

- ***Better utilizing texting and other capabilities of smart phones*** to communicate with families, children, and staff members.

- ***Exploring how to better scaffold the ways that families use books*** as inspirations for new engineering design challenges. For example, the program could sequentially model this process with the current activity books, a new book selected by the program team, and finally books selected by participant families.

- ***Considering how important it is for participating families to associate the program with science, math, and engineering*** careers, since these associations decreased between the pre- and post-program surveys.

- ***Finding other ways to introduce and invite families to participate in the HSE program*** besides the initial family engineering night. This could include using existing parent nights to introduce HSE and allowing more time for evening workshops. The program could also be presented at the start of the year during the enrollment fair, when families sign up for Head Start.

Data Collection Recommendations

The set of measures, instruments, and protocols developed and piloted during this phase of the project provides an excellent toolkit for ongoing program improvement and knowledge development. These will be updated and refined based on findings and feedback from the current year. For example, one challenge with the current versions of the parent and teacher surveys is the potential for ceiling effects because participants already rate their engineering values and attitudes as high at the beginning of the program. Possible solutions include: (a) changing the timing of surveys to capture participant perceptions before they have been introduced to the program; (b) using comparative measures of interest and value (e.g., how valuable engineering is for children compared to other topics); and (c) using retrospective pre-program measures (e.g., asking participants to indicate how much their value for engineering has increased since the beginning of the program). Retrospective measures may also help with accessibility, since many parents had trouble thinking about their

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engineering interests and values before they had been introduced to the topic.

The team is also considering a number of other changes, such as: (a) improving participation tracking systems; (b) making updates to evaluation instruments and measures to improve accessibility, reliability, and validity; (c) better aligning the teacher and parent surveys; (d) finding ways to streamline data collection for families and teachers (especially at the end of the school year), such as only conducting in-depth interviews with a subset of families, creating optional online versions of the parent and teacher surveys, and asking for demographics directly from families; (e) and planning for high turnover rates with families and teachers, as is common in the Head Start system.

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References

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, N.J: Erlbaum Associates.

Field, A. P., Miles, J., & Field, Z. (2012). *Discovering statistics using R*. Thousand Oaks, CA: Sage.

Organization for Economic Cooperation and Development (OECD). (2009). *PISA 2006 technical report*. Retrieved from http://www.oecd.org/pisa/pisaproducts/42025182.pdf

Pattison, S. A. (2014). *Exploring the foundations of science interest development in early childhood* (Doctoral dissertation, Oregon State University). Retrieved from http://hdl.handle.net/1957/54783

Pattison, S. A., Núñez, V., Smith, C., Svarovsky, G. N., Benne, M., Corrie, P., & Stewart, R. (2018). *Introduction to the Head Start on Engineering pilot program: Engaging families with preschool children in the engineering design process*. Retrieved from: https://HSE.TERC.edu

Pattison, S. A., Svarovsky, G. N., Corrie, P., Benne, M., Nuñez, V., Dierking, L. D., & Verbeke, M. (2016). *Conceptualizing early childhood STEM interest development as a distributed system: A preliminary framework*. Presented at the National Association for Research in Science Teaching Annual Conference, Baltimore, MD. Retrieved from http://www.informalscience.org/conceptualizing-early-childhood-stem-interest-development-distributed-system-preliminary-framework

Pattison, S. A., Svarovsky, G. N., Gontan, I., Corrie, P., Benne, M., Weiss, S., … Ramos-Montañez, S. (2017). Teachers, informal STEM educators, and learning researchers collaborating to engage low-income families with engineering. *Connected Science Learning, 4*. Retrieved from http://csl.nsta.org/2017/10/head-start-engineering/

Pattison, S. A., Svarovsky, G. N., Ramos-Montañez, S., Gontan, I., Weiss, S., Corrie, P., … Nunes, V. (2019). *Understanding early childhood engineering interest development as a family-level systems phenomenon: Findings from the Head Start in Engineering project*. Manuscript in review.

Pattison, S. A., Weiss, S., Ramos-Montañez, S., Gontan, I., Svarovsky, G., Corrie, P. G., … Smith, C. (2018). *Engineering in early childhood: Describing family-level interest development systems*. Presented at the NARST 91st Annual International Conference, Atlanta, GA. Retrieved from http://informalscience.org/engineering-early-childhood-describing-family-level-interest-development-systems

Svarovsky, G. N., Pattison, S. A., Verbeke, M., Benne, M., & Corrie, P. (2017). *Head Start on Engineering: Early findings (work in progress)*. Presented at the ASEE Annual Conference & Exposition, Columbus, OH. Retrieved from https://www.asee.org/public/conferences/78/papers/20296/view

Yun, J., Cardella, M., Purzer, S., Hsu, M.-C., & Chae, Y. (2010). *Development of the parents' engineering awareness survey (PEAS) according to the knowledge, attitudes, and behavior framework*. Presented at the ASEE 2010 Annual Conference & Exposition, Louisville, KY. Retrieved from https://peer.asee.org/development-of-the-parents-engineering-awareness-survey-peas-according-to-the-knowledge-attitudes-and-behavior-framework.pdf

HEAD START ON
ENGINEERING

APPENDICES

APPENDIX A: Example Recruitment Flyer (English)

Head Start on Engineering Parent Workshop Series (Fairview/Troutdale)

Interested in introducing your child to engineering and taking home free engineering activity kits for your family? Fairview and Troutdale Head Start locations are recruiting for the Head Start on Engineering program (HSE). The program will include three evening workshops for parents or caregivers, four take-home engineering activity kits, a field trip to OMSI, and more. HSE is free, and all events and materials are in Spanish and English. <u>Families that participate will receive six free admission tickets to OMSI and the chance to apply for a reduced-fee OMSI membership.</u>

What will you be asked to do as part of the program?

- **Attend three evening parent workshops** at the Troutdale Head Start center on February 20, March 20, and April 17 from 6:30 to 8 PM. Dinner and child care will be provided.
- **Attend a field trip to OMSI** the evening of May 7. Limited transportation will be provided.
- **Talk to your Head Start teacher about the program** during your regular home visit.
- **Complete two confidential surveys** (in Spanish or English) to help improve the program.
- **Share your feedback** at the end of the year.

<u>Space is limited to 15 families, so be sure you are able to commit to all dates and activities listed above.</u>

ENGINEERING

Head Start on Engineering Parent Workshop Series (Fairview/Troutdale)

¿Está interesado en introducir a su hijo/a a la ingeniería y llevarse a casa actividades de ingeniería gratuitas para su familia? Head Start está reclutando familias para el programa Head Start on Engineering (HSE). El programa incluirá tres talleres (que se llevarán a cabo en la noche) para padres o cuidadores, cuatro kits de actividades de ingeniería para llevar a casa, un paseo a OMSI y más. HSE es gratis, y todos los eventos y materiales están en español e inglés. Todas las familias que participen recibirán seis boletos de admisión gratuita a OMSI y la posibilidad de solicitar una membresía de OMSI de tarifa reducida.

¿Qué se hará si decide participar en el programa?
- **Asistir a tres talleres para padres** en el centro de Head Start Troutdale el 20 de febrero, el 20 de marzo y el 17 de abril de 6:30 a 8 PM. Se proporcionará cena y cuidado de niños.
- **Asistir a un paseo a OMSI** la noche del 7 de mayo. Habrá transporte limitado.
- **Hablar con su maestro de Head Start sobre el programa** durante una de las visitas regulares al hogar.
- **Completar dos encuestas confidenciales** (en español o inglés) para ayudar a mejorar el programa.
- **Compartir sus comentarios** al final del año escolar.

El límite es de 15 familias, así que asegúrese que puede participar en todas las fechas y actividades mencionadas anteriormente.

APPENDIX C: Parent Pre-Program Survey (English)

The Institute for Learning Innovation, Mt. Hood Committee College Head Start, Oregon Museum of Science and Industry (OMSI), and University of Notre Dame are working together on a community research and family engagement program around the topic of engineering. Please share your thoughts and feedback so that we can create a successful program for families and children. All of your responses will be confidential. You can choose to skip any questions that you don't want to answer and you can decide not to continue the survey at any point.

There are no right or wrong answers to these questions. Your feedback is important, so just answer as honestly as you can. Thank you for your help!

1) Name: _____

(Your name will only be used to connect this information to your future responses. All your feedback will remain confidential.)

2) What other Head Start on Engineering activities have you been involved in (mark all that apply)?

Family engineering nights at Head Start	Parent evening workshop at Head Start
OMSI field trip	Home visits or parent conferences
Other (please describe) _____	

3) If a friend asked you <u>what engineering is</u>, what would you tell them?

_____

_____

_____

_____

4) What are ways that you would say <u>engineering relates to your everyday life</u>, if at all?

_____

_____

_____

_____

HEAD START ON
ENGINEERING

5) The following question asks about _your views about engineering_. How much do you agree with the following statements? (Please mark one answer per statement.)

	Completely disagree	Disagree	In the Middle	Agree	Completely agree
a. There are many opportunities for me to use engineering in my everyday life.					
b. Engineering is relevant to me.					
c. I believe engineering improves our quality of life.					
d. I find that engineering helps me solve problems in my daily life.					
e. I am interested in learning engineering skills.					
f. Engineering is boring to me.					
g. I generally have fun when I am doing engineering activities or using engineering skills.					

6) The next question asks about _your views about engineering and your child_. How much do you agree with the following statements? (Please mark one answer per statement.)

	Completely disagree	Disagree	In the Middle	Agree	Completely agree
a. I believe that learning engineering skills is good for young children.					
b. I think engineering skills will be useful for my children in the future.					
c. I think it is important to learn engineering as early as possible.					
d. I would like my child to learn engineering, but the school day is already too full to include this topic.					
e. Learning engineering skills supports other areas of my child's development.					
f. My child is too young to learn engineering skills.					
g. Doing engineering activities is a good way for me to spend time with my child.					

HEAD START ON
ENGINEERING

7) This question asks about _your comfort doing engineering with your child_. How much do you agree with the following statements? (Please mark one answer per statement.)

	Completely disagree	Disagree	In the Middle	Agree	Completely agree
a. I am comfortable talking with my child about engineering.					
b. I am comfortable doing engineering activities with my child.					
c. I am comfortable teaching engineering skills to my child.					
d. I have ideas about how to find more engineering information to help my child.					
e. I have ideas about how to support my child's interests in engineering.					
f. I feel comfortable connecting engineering to other things my child is interested in.					

8). What are other ways you think _engineering is valuable for you and your child_, if at all?

_____

9). How often did _you and/or your child_ do the following activities _in the last three months_? (Please mark one answer per statement.)

	Never	Once a month or less	Several times a month	Several times a week	Once a day or more
a. Talk about engineering.					
b. Use the word "engineer" or "engineering."					
c. Call your child or someone else an "engineer."					
d. Find examples of engineering in everyday life.					
e. Create new engineering activities.					
f. Use engineering skills when playing with your child.					
g. Use engineering skills in some other part of your life, such as work, hobbies, or projects at home.					
h. Find a new resource related to engineering, such an activity, toy, book, or TV program.					
i. Seek out a new experience related to engineering, such as a class, event, or museum visit.					
j. Teach someone else about engineering or engineering skills.					

HEAD START ON
ENGINEERING

10). Is there anything else <u>you or your child</u> has done in the last three months related to engineering?

_____

_____

_____

_____

11). We are trying to make our surveys better. Was there anything about this survey that didn't make sense or you think could be improved?

_____

_____

_____

_____

12). Anything else you'd like to share with the Head Start on Engineering project team?

_____

_____

_____

_____

Thank you!

HEAD START ON
ENGINEERING

APPENDIX D: Parent Pre-Program Survey (Spanish)

Institute for Learning Innovation, Mt. Hood Committee College Head Start, Oregon Museum of Science and Industry (OMSI), y University of Notre Dame están trabajando juntos en un programa de investigación y participación familiar acerca del tema de ingeniería. Por favor comparta su opinión y comentarios para que así podamos crear un programa exitoso tanto para las familias como para los niños. Todas sus respuestas serán anónimas. Puede omitir cualquier pregunta que no quiera contestar y puede decidir no continuar con el cuestionario cuando desee.

No hay respuestas correctas o incorrectas a estas preguntas. Sus comentarios son importantes, por favor conteste lo más honestamente posible. ¡Gracias por su ayuda!

1) Nombre: _____

(Su nombre se usará solo para conectar esta información con sus futuras respuestas. Todos sus comentarios permanecerán confidenciales.)

2) ¿En qué otras actividades de Head Start en Ingeniería ha estado involucrado(a) (marque todo lo que corresponda)?

Noches familiares de ingeniería en Head Start	Talleres vespertinos para padres de familia en Head Start
Visitas a OMSI	Visitas a domicilio o conferencias para padres de familia
Otro (por favor especifique) _____	

3) ¿Si un amigo(a) le pregunta <u>qué es la ingeniería</u>, usted qué le diría?

_____
_____
_____
_____

4) ¿De qué manera usted diría que <u>la ingeniería se relaciona con su vida diaria</u>, si así sucede?

_____
_____
_____
_____

HEAD START ON
ENGINEERING

5) Las siguientes preguntas tienen que ver con <u>su opinión acerca de la ingeniería</u>. ¿Qué tan de acuerdo está con las siguientes frases? (Por favor marque solo una respuesta por frase.)

	Completamente en desacuerdo	En desacuerdo	En el medio	De acuerdo	Completamente de acuerdo
a. Tengo muchas oportunidades para usar ingeniería en mi vida diaria.					
b. La ingeniería es relevante para mí.					
c. Yo creo que la ingeniería mejora nuestra calidad de vida.					
d. Encuentro que la ingeniería me ayuda a resolver problemas en mi vida diaria.					
e. Estoy interesado en aprender habilidades en ingeniería.					
f. La ingeniería es aburrida para mí.					
g. Generalmente me divierto cuando estoy haciendo actividades de ingeniería o utilizo esas habilidades.					

6) Las siguientes preguntas tienen que ver con <u>su opinión acerca de la ingeniería y su hijo(a).</u> ¿Qué tan de acuerdo está con las siguientes frases? (Por favor marque solo una respuesta por frase.)

	Completamente en desacuerdo	En desacuerdo	En el medio	De acuerdo	Completamente de acuerdo
a. Yo creo que aprender habilidades de ingeniería es bueno para niños(as) pequeños(as).					
b. Yo creo que las habilidades de ingeniería serán útiles para mis hijos(as) en el futuro.					
c. Yo creo que es importante aprender ingeniería lo más temprano posible.					
d. Me gustaría que mi hijo(a) aprenda ingeniería, pero el día escolar está demasiado lleno para incluir este tema.					
e. Aprender habilidades de ingeniería apoya otras áreas en el desarrollo de mi hijo(a).					
f. Mi hijo(a) es muy joven para aprender habilidades de ingeniería.					
g. Realizar actividades de ingeniería es una buena manera de pasar más tiempo con mi hijo(a).					

HEAD START ON
ENGINEERING

7) Esta pregunta es acerca de <u>su comodidad mientras trabajan en ingeniería con su hijo(a)</u>. ¿Qué tan de acuerdo está con las siguientes frases? (Por favor marque solo una respuesta por frase.)

	Completamente en desacuerdo	En desacuerdo	En el medio	De acuerdo	Completamente de acuerdo
a. Me siento a gusto hablando con mi hijo(a) sobre ingeniería.					
b. Me siento a gusto realizando actividades de ingeniería con mi hijo(a).					
c. Me siento a gusto enseñando habilidades de ingeniería a mi hijo(a).					
d. Tengo ideas de cómo encontrar más información sobre ingeniería para ayudar a mi hijo(a).					
e. Tengo ideas de como apoyar el interés de mi hijo(a) en ingeniería.					
f. Me siento a gusto conectando la ingeniería con otras cosas en las que mi hijo(a) está interesado(a).					

8) ¿De qué otras maneras piensa usted que <u>la ingeniería es valiosa para usted y su hijo(a)</u>, si así sucede?

_____

9) ¿Cuán a menudo <u>usted y/o su hijo(a)</u> realizaron las siguientes actividades <u>en los últimos 3 meses</u>? (Por favor marque solo una respuesta por frase.)

	Nunca	Una vez al mes o menos	Varias veces al mes	Varias veces a la semana	Una vez al día o mas
a. Hablar acerca de ingeniería.					
b. Utilizar la palabra "ingeniero(a)" o "ingeniería."					
c. Llamar a su hijo(a) o a alguien más "ingeniero(a)."					
d. Encontrar ejemplos de ingeniería en su vida diaria.					
e. Crear nuevas actividades de ingeniería.					
f. Utilizar habilidades de ingeniería cuando juega con su hijo(a).					
g. Utilizar habilidades de ingeniería en otros momentos de su vida, como en su trabajo, pasatiempos o proyectos en casa.					
h. Encontrar nuevos recursos relacionados con la ingeniería, como una actividad, juguete, libro o programa de televisión.					
i. Buscar nuevas experiencias relacionadas a la ingeniería, como una clase, evento o visita a un museo.					
j. Enseñar a alguien más sobre la ingeniería o sus habilidades.					

HEAD START ON
ENGINEERING

10) ¿Hay algo más que usted y su hijo(a) han hecho en los últimos tres meses relacionado con la ingeniería?

_____

_____

_____

_____

11) Estamos tratando de mejorar nuestras encuestas. ¿Hubo algo en este cuestionario que no tenía sentido o que puede ser mejorado?

_____

_____

_____

_____

12) ¿Algo más que le gustaría compartir con el equipo del proyecto Head Start en Ingeniería?

_____

_____

_____

_____

¡Muchas Gracias!

HEAD START ON
ENGINEERING

APPENDIX E: Parent Post-Program Survey (English)

Thank you for participating in Head Start on Engineering! Please share your feedback so that we can improve the program for other families. All of your responses will be confidential. You can skip any questions that you don't want to answer and you can end the survey at any point.

There are no right or wrong answers. Your feedback is important, so just answer as honestly as you can. <u>These questions are for you as a parent</u>, so don't worry about asking your child. Many of the questions are the same as the first survey. Please respond based on <u>how you feel now</u> after the program.

Thank you for your help!

1) Your name: _____   **2) Today's date** _____

3) Names of your children in Head Start: _____

(These names will only be used to connect this information to your other responses. All your feedback will remain confidential.)

4) If a friend asked you <u>what engineering is</u>, what would you tell them?

_____

_____

_____

_____

5) What are ways that you would say <u>engineering relates to your everyday life</u>, if at all?

_____

_____

_____

_____

HEAD START ON
ENGINEERING

6) The following question asks about <u>your views about engineering</u>. How much do you agree with the following statements? (Please mark one answer per statement.)

	Completely disagree	Disagree	In the Middle	Agree	Completely agree
a. There are many opportunities for me to use engineering in my everyday life.					
b. Engineering is relevant to me.					
c. I believe engineering improves our quality of life.					
d. I find that engineering helps me solve problems in my daily life.					
e. I am interested in learning engineering skills.					
f. Engineering is boring to me.					
g. I generally have fun when I am doing engineering activities or using engineering skills.					

7) The next question asks about <u>your views about engineering and your child</u>. How much do you agree with the following statements? (Please mark one answer per statement.)

	Completely disagree	Disagree	In the Middle	Agree	Completely agree
a. I believe that learning engineering skills is good for young children.					
b. I think engineering skills will be useful for my children in the future.					
c. I think it is important to learn engineering as early as possible.					
d. I would like my child to learn engineering, but the school day is already too full to include this topic.					
e. Learning engineering skills supports other areas of my child's development.					
f. My child is too young to learn engineering skills.					
g. Doing engineering activities is a good way for me to spend time with my child.					

HEAD START ON
ENGINEERING

8) This question asks about <u>your comfort doing engineering with your child</u>. How much do you agree with the following statements? (Please mark one answer per statement.)

	Completely disagree	Disagree	In the Middle	Agree	Completely agree
a. I am comfortable talking with my child about engineering.					
b. I am comfortable doing engineering activities with my child.					
c. I am comfortable teaching engineering skills to my child.					
d. I have ideas about how to find more engineering information to help my child.					
e. I have ideas about how to support my child's interests in engineering.					
f. I feel comfortable connecting engineering to other things my child is interested in.					

9) What are other ways you think <u>engineering is valuable for you and your child</u>, if at all?

_____

_____

10) How often did <u>you and/or your child</u> do the following activities related to the Head Start on Engineering program <u>in the last three months</u>? (Please mark one answer per statement.)

	Never	Once a month or less	Several times a month	Several times a week	Once a day or more
a. Talk about the Head Start on Engineering activities or program.					
b. Play with the *Fox and Hen* activity kit.					
c. Play with the *Mouse Run* activity kit.					
d. Play with the *Bubble Wands* activity kit.					
e. Play with the *Bird Nest* activity kit.					
f. Read one of the books from the Head Start on Engineering activity kits.					
g. Use the Head Start on Engineering activities or books with other friends or family members besides you and your child.					
h. Find new ways to use the Head Start on Engineering activity kits, such as adding new materials or creating new challenges.					
i. Use the Head Start on Engineering activities or books in your child's classroom.					

HEAD START ON
ENGINEERING

11) How often did <u>you and/or your child</u> do the following activities related to engineering <u>in the last three months</u>? (Please mark one answer per statement.)

	Never	Once a month or less	Several times a month	Several times a week	Once a day or more
a. Talk about engineering.					
b. Use the word "engineer" or "engineering."					
c. Call your child or someone else an "engineer."					
d. Find examples of engineering in everyday life.					
e. Create new engineering activities.					
f. Use engineering skills when playing with your child.					
g. Use engineering skills in some other part of your life, such as work, hobbies, or projects at home.					
h. Find a new resource related to engineering, such an activity, toy, book, or TV program.					
i. Seek out a new experience related to engineering, such as a class, event, or museum visit.					
j. Teach someone else about engineering or engineering skills.					

12) Did you or other members of your family attend the evening visit to OMSI on May 7?

Yes	No

13) How likely are you to recommend this program to other Head Start families?

Not at all likely	Not very likely	In the middle	Likely	Very likely

14) Is there anything else <u>you or your child</u> has done in the last three months related to engineering or the Head Start on Engineering program?

_____

15) We are trying to make our surveys better. Was there anything about this survey that didn't make sense or you think could be improved?

_____

16) Anything else you'd like to share with the Head Start on Engineering project team?

_____

Thank you!

HEAD START ON **ENGINEERING**

APPENDIX F: Parent Post-Program Survey (Spanish)

¡Gracias por participar en Head Start en Ingeniería! Por favor, comparta sus comentarios para que podamos mejorar el programa para otras familias. Todas sus respuestas serán confidenciales. Puede omitir cualquier pregunta que no desee contestar y puede finalizar la encuesta en cualquier momento.

No hay respuestas correctas o incorrectas a estas preguntas. Sus comentarios son importantes, por favor conteste lo más honestamente posible. Estas preguntas son para usted como padre/madre/guardián, así que no se preocupe por preguntarle a su hijo(a). Muchas de las preguntas son las mismas de la primera encuesta. Responda según cómo se siente ahora después del programa.

¡Gracias por su ayuda!

1) Nombre: _____   **2) Fecha de hoy:** _____

3) Nombre(s) de su(s) hijos(as) en Head Start: _____

(Estos nombres solamente serán usados para conectar información con otras respuestas. Todas sus opiniones permanecerán confidenciales.)

4) ¿Si un amigo(a) le pregunta qué es la ingeniería, usted qué le diría?

_____

_____

_____

_____

5) ¿De qué manera usted diría que la ingeniería se relaciona con su vida diaria, si así sucede?

_____

_____

_____

_____

HEAD START ON
ENGINEERING

6) Las siguientes preguntas tienen que ver con _su opinión acerca de la ingeniería_. ¿Qué tan de acuerdo está con las siguientes frases? (Por favor marque solo una respuesta por frase.)

	Completamente en desacuerdo	En desacuerdo	En el medio	De acuerdo	Completamente de acuerdo
a. Tengo muchas oportunidades para usar ingeniería en mi vida diaria.					
b. La ingeniería es relevante para mí.					
c. Yo creo que la ingeniería mejora nuestra calidad de vida.					
d. Encuentro que la ingeniería me ayuda a resolver problemas en mi vida diaria.					
e. Estoy interesado en aprender habilidades en ingeniería.					
f. La ingeniería es aburrida para mí.					
g. Generalmente me divierto cuando estoy haciendo actividades de ingeniería o utilizo esas habilidades.					

7) Las siguientes preguntas tienen que ver con _su opinión acerca de la ingeniería y su hijo(a)._ ¿Qué tan de acuerdo está con las siguientes frases? (Por favor marque solo una respuesta por frase.)

	Completamente en desacuerdo	En desacuerdo	En el medio	De acuerdo	Completamente de acuerdo
a. Yo creo que aprender habilidades de ingeniería es bueno para niños(as) pequeños(as).					
b. Yo creo que las habilidades de ingeniería serán útiles para mis hijos(as) en el futuro.					
c. Yo creo que es importante aprender ingeniería lo más temprano posible.					
d. Me gustaría que mi hijo(a) aprenda ingeniería, pero el día escolar está demasiado lleno para incluir este tema.					
e. Aprender habilidades de ingeniería apoya otras áreas en el desarrollo de mi hijo(a).					
f. Mi hijo(a) es muy joven para aprender habilidades de ingeniería.					
g. Realizar actividades de ingeniería es una buena manera de pasar más tiempo con mi hijo(a).					

HEAD START ON
ENGINEERING

8) Esta pregunta es acerca de <u>su comodidad mientras trabajan en ingeniería con su hijo(a)</u>. ¿Qué tan de acuerdo está con las siguientes frases? (Por favor marque solo una respuesta por frase.)

	Completamente en desacuerdo	En desacuerdo	En el medio	De acuerdo	Completamente de acuerdo
a. Me siento a gusto hablando con mi hijo(a) sobre ingeniería.					
b. Me siento a gusto realizando actividades de ingeniería con mi hijo(a).					
c. Me siento a gusto enseñando habilidades de ingeniería a mi hijo(a).					
d. Tengo ideas de cómo encontrar más información sobre ingeniería para ayudar a mi hijo(a).					
e. Tengo ideas de como apoyar el interés de mi hijo(a) en ingeniería.					
f. Me siento a gusto conectando la ingeniería con otras cosas en las que mi hijo(a) está interesado(a).					

9) ¿De qué otras maneras piensa usted que <u>la ingeniería es valiosa para usted y su hijo(a)</u>, si así sucede?

_____

_____

10) ¿Cuán a menudo <u>usted y/o su hijo(a)</u> realizaron las siguientes actividades relacionadas con el programa de Head Start en Ingeniería <u>en los últimos 3 meses</u>? (Por favor marque solo una respuesta por frase.)

	Nunca	Una vez al mes o menos	Varias veces al mes	Varias veces a la semana	Una vez al día o mas
a. Hablar acerca de las actividades o programas de Head Start en Ingeniería.					
b. Jugar con el kit de actividades *El zorro y la gallina*.					
c. Jugar con el kit de actividades *¡Corre, ratón!*					
d. Jugar con el kit de actividades *Varas para burbujas*.					
e. Jugar con el kit de actividades *Nido de pájaros*.					
f. Leer uno de los libros en los kits de actividades de Head Start en Ingeniería.					
g. Utilizar los libros o actividades de Head Start en Ingeniería con otros(as) amigos(as) o miembros de la familia además de usted y su hijo(a).					
h. Encontrar nuevas maneras de utilizar los kits de actividades de Head Start en Ingeniería, tal como añadir nuevos materiales o crear nuevos desafíos.					
i. Utilizar las actividades o libros de Head Start en Ingeniería en la clase de su hijo(a).					

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11) ¿Cuán a menudo <u>usted y/o su hijo(a)</u> realizaron las siguientes actividades relacionadas con la ingeniería <u>en los últimos 3 meses</u>? (Por favor marque solo una respuesta por frase.)

	Nunca	Una vez al mes o menos	Varias veces al mes	Varias veces a la semana	Una vez al día o mas
a. Hablar acerca de ingeniería.					
b. Utilizar la palabra "ingeniero(a)" o "ingeniería."					
c. Llamar a su hijo(a) o a alguien más "ingeniero(a)."					
d. Encontrar ejemplos de ingeniería en su vida diaria.					
e. Crear nuevas actividades de ingeniería.					
f. Utilizar habilidades de ingeniería cuando juega con su hijo(a).					
g. Utilizar habilidades de ingeniería en otros momentos de su vida, como en su trabajo, pasatiempos o proyectos en casa.					
h. Encontrar nuevos recursos relacionados con la ingeniería, como una actividad, juguete, libro o programa de televisión.					
i. Buscar nuevas experiencias relacionadas a la ingeniería, como una clase, evento o visita a un museo.					
j. Enseñar a alguien más sobre la ingeniería o sus habilidades.					

12) ¿Asistió usted o miembros de su familia a la visita a OMSI el día 7 de mayo?

Sí	No

13) ¿Qué tan probable es que recomiende este programa a otras familias de Head Start?

Muy improbable	No muy probable	En el medio	Probable	Muy probable

14) ¿Hay algo más que usted y su hijo(a) han hecho en los últimos tres meses relacionado con la ingeniería o con el programa Head Start en Ingeniería?

_____

15) Estamos tratando de mejorar nuestras encuestas. ¿Hubo algo en este cuestionario que no tenía sentido o que puede ser mejorado?

_____

16) ¿Algo más que le gustaría compartir con el equipo del proyecto Head Start en Ingeniería?

_____

¡Muchas Gracias!

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APPENDIX G: Parent Post-Program Interview Guide

1) **Collect the completed survey.** If the survey is not yet completed, give the parent time to finish it before starting the interview. Here are a few things to remind parents before they start the survey:
   - *Su opinión es muy importante para: a) mejorar el programa para otras familias y niños y b) comunicar el valor del programa a posibles patrocinadores.*
   - *No hay respuestas correctas o incorrectas. Solo responda tan honestamente como pueda.*
   - *Esta encuesta está dirigida <u>solo a usted como padre/madre/guardián</u>. No es necesario que haga preguntas a su hijo (a).*
   - *Muchas de las preguntas son las mismas que en la primera encuesta. Por favor, responda en función de <u>cómo se siente ahora</u> que terminó el programa.*
   - *Incluso si no pudo participar en el programa o si solo pudo participar en algunas reuniones, su opinión sigue siendo muy valiosa. Puede ayudarnos a hacer que el programa sea más accesible para otras familias en el futuro.*

   - *You feedback is very important to (a) improve the program for other families and children and (b) communicate the value of the program to potential funders.*
   - *There are no right or wrong answers. Just answer as honestly as you can.*
   - *This survey is <u>just for you as the parent</u>. You don't need to ask the questions to your child.*
   - *Many of the questions are the same as the first survey. Please respond based on <u>how you feel now</u> after the program is over.*
   - *Even if you weren't able to participate in the program, or you were only able to participate in some meetings, your feedback is still very valuable. You can help us make the program more accessible to other families in the future.*

2) **Start by introducing the parent to the feedback process using the general script below:**
   Gracias por participar en el Proyecto de Head Start en Ingeniería y darnos su opinión a través del proceso. Ahora nos gustaría obtener sus opiniones y pensamientos acerca del programa para que nosotros podamos mejorarlo en el futuro. Primero, le voy a hacer unas preguntas. Su perspectiva es muy importante, así que por favor sea lo más honesto(a) posible.
   Thanks so much for participating in the Head Start on Engineering project and providing your input throughout the process. Now we want to get your feedback on the whole program so that we can make improvements in the future. First, I'm going to ask you some questions. Your perspective is very important, so please be as honest as you can.

3) **Facilitate an informal conversation with the parent using the questions on the next page.** Try to stick to the question wording and order, but feel free to clarify if the parent seems confused or uncertain. Take notes about the parent's response (as close to their actual words as possible). Try not to "lead" the parent towards a particular answer.

4) **Thank the parent for their help and remind them that they will receive six free OMSI admission passes for completing the survey and feedback conversation** (even if they couldn't attend the workshops).

5) **Scan the survey and written notes and send them to the project team.**

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Conversation Questions (for parents that attended at least one workshop)

Parent name: _____ Child name: _____ Date: _____

1) **¿Cómo fue su experiencia con el programa en general? / How was your experience with the program overall?**

_____

_____

_____

2) **¿Cuáles diría que fueron las partes del programa que tuvieron más éxito para usted y su hijo(a)? / What would you say were some of the most successful parts of this program for you and your child?**

_____

_____

_____

3) **¿De qué forma podríamos mejorar el programa para otras familias? / What are some ways we could improve the program and make it better for other families?**

_____

_____

_____

   a. **Follow-up question after initial response: ¿Qué otra clase de apoyo hubiera sido importante para usted como padre/madre/guardián? / What other support would have been helpful for you as a parent?**

   _____

   _____

   b. **Follow-up question after initial response: ¿Qué otros temas y actividades hubieran sido útiles durante los talleres de padres? / What other topics and activities would have been useful during the evening workshops?**

   _____

   _____

   c. **Follow-up question after initial response: ¿De qué forma este programa hubiera podido conectarse mejor con la cultura, intereses y experiencias de su familia? / How could this program have better connected with your family's culture, interests, and experiences?**

   _____

   _____

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4) **Los videos del kit de actividades fueron nuevos en el programa este año. ¿Vio los videos después de los talleres? Si es que lo hicieron, ¿de qué forma le ayudaron?** The activity kit videos were new to the program this year. Did you watch the videos after the workshops? In what ways, if at all, did they help?

_____

_____

_____

5) **Muchas familias que se registraron en el programa no pudieron asistir a los talleres nocturnos. ¿Cómo podríamos ayudar a que sea más fácil para ellos(as) asistir en el futuro?** Many families who signed up for the program weren't able to attend all of the evening workshops. How can we encourage and make it easier for parents to attend in the future?

_____

_____

_____

6) **¿Cuáles diría usted son algunas de las formas en que el programa incentivó cambios positivos en usted, su hijo(a) o su familia? / What are some ways you would say the program supported positive changes for you, your child, and your family?**

_____

_____

_____

7) **¿Tiene otras ideas o preguntas para nosotros? / Do you have any other thoughts or questions for us?**

_____

_____

_____

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Conversation Questions (for parents that didn't attend any of the workshops)

Parent name: _____   **Child name:** _____   **Date:** _____

1) **Sé que fue un reto asistir a los talleres para padres en la noche. ¿En qué partes del programa pudo participar (como usando los kits de actividades, por ejemplo)?** / **I know it was challenging to attend the evening parent workshops. What parts of the program were you able to participate in (such as using the activity kits)?**

_____

_____

_____

2) **¿Cuál fue su experiencia con estos?** / **How was your experience with these?**

_____

_____

_____

3) **Para que podamos ayudar a los padres en el futuro, ¿cuáles fueron las razones por las cuales no pudo asistir a los talleres para padres?** / **So that we can help parents in the future, what are some of the reasons you weren't able to attend the parent workshops?**

_____

_____

_____

4) **¿Cómo podemos ayudar a que estos padres asistan a los talleres nocturnos en el futuro?** / **How can we encourage and make it easier for parents to attend the evening workshops in the future?**

_____

_____

_____

5) **¿Tiene más preguntas u observaciones para nosotros?** / **Do you have any other thoughts or questions for us?**

_____

_____

_____

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APPENDIX H: Head Start Staff Pre-Program Survey

The Institute for Learning Innovation, Mt. Hood Committee College Head Start, Oregon Museum of Science and Industry (OMSI), and University of Notre Dame are working together on an exciting community research and family engagement program around the topic of engineering. Please share your thoughts and feedback so that we can create a successful program for families and children. All of your responses will be confidential. You can choose to skip any questions that you don't want to answer and you can decide not to continue the survey at any point. ***Thank you for your help!***

1) Name: _____

(Your name will only be used to connect this information to your future responses. All your feedback will remain confidential.)

2) What other Head Start on Engineering activities have you been involved in (mark all that apply)?

Professional development workshop	Family engineering nights at Head Start
Parent evening workshop at Head Start	OMSI field trip
Project planning meeting	Research data collection
Home visits or parent conferences	

Other (please describe) _____

3) When you hear the word "engineering," what does it make you think of? <u>Write or draw </u>anything that comes to mind.

4) What are ways that you would say <u>engineering is relevant to everyday life</u>, including work, school, activities at home, or time with friends and family?

_____

_____

_____

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5) The following question asks about <u>your views towards engineering</u>. How much do you agree with the following statements? (please mark one answer per statement)

		Completely agree	Agee	In the Middle	Disagree	Completely disagree
h.	There are many opportunities for me to use engineering in my everyday life.					
i.	Engineering is very relevant to me.					
j.	I find that engineering helps me solve problems in my daily life.					
k.	I believe engineering improves our quality of life.					
l.	I am interested in learning about engineering.					
m.	I generally have fun when I am learning about engineering or practicing engineering skills.					
n.	I like doing engineering activities or using engineering skills.					
o.	I know how to apply engineering concepts in my daily life.					
p.	I know how to identify and solve problems using engineering.					

6) The next question asks about <u>your views towards engineering and early childhood education</u>. How much do you agree with the following statements? (please mark one answer per statement)

		Completely agree	Agee	In the Middle	Disagree	Completely disagree
h.	I think that engineering is worth studying.					
i.	I believe that learning engineering ideas and skills is good for young children.					
j.	I think engineering skills will be useful for children's careers.					
k.	I think engineering ideas and skills will be useful for children in school.					
l.	It is important for Head Start children and their families to learn about engineering.					
m.	I want Head Start children and their families to learn engineering skills.					
n.	I think it is necessary to learn engineering as early as possible.					
o.	I would like Head Start children and their families to learn engineering, but the school day is already too full to include this topic.					

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7) This question asks about <u>your confidence with engineering</u>. How much do you agree with the following statements? (please mark one answer per statement)

	Completely agree	Agee	In the Middle	Disagree	Completely disagree
g. I am comfortable talking with preschool children and their families about engineering.					
h. I am comfortable doing engineering-related activities with preschool children and their families.					
i. I know how engineering is different from science.					
j. I know how to teach engineering skills to preschool children and their families.					
k. I know how to help preschool children and their families develop their engineering ideas and skills.					
l. I know how to find more engineering information to help Head Start children and their families.					
m. I know where to search to find more information about engineering.					

8). What are other ways you think engineering is valuable or relevant for you or Head Start families?

_____

_____

_____

9). We are trying to improve our surveys for the future. Was there anything about this survey that didn't make sense or you think could be improved?

_____

_____

_____

10). Anything else you'd like to share with the Head Start on Engineering project team?

_____

_____

_____

Thank you!

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APPENDIX I: Head Start Staff Post-Program Survey

Thank you for participating in Head Start on Engineering! Please share your feedback so that we can improve the program for the future. All of your responses will be confidential. You can skip any questions that you don't want to answer and you can end the survey at any point.

There are no right or wrong answers. Your feedback is important, so just answer as honestly as you can. Many of the questions are the same as the first survey. Please respond based on <u>how you feel now</u> after the program.

Thank you for your help!

1) Your name: _____   **2) Today's date** _____

(Your name will only be used to connect this information to your past responses. All your feedback will remain confidential.)

3) If a friend asked you <u>what engineering is</u>, what would you tell them?

_____

_____

_____

_____

4) What are ways that you would say <u>engineering relates to your everyday life</u>, if at all?

_____

_____

_____

_____

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5) The following question asks about <u>your views towards engineering</u>. How much do you agree with the following statements? (Please mark one answer per statement.)

		Completely disagree	Disagree	In the Middle	Agree	Completely agree
q.	There are many opportunities for me to use engineering in my everyday life.					
r.	Engineering is very relevant to me.					
s.	I find that engineering helps me solve problems in my daily life.					
t.	I believe engineering improves our quality of life.					
u.	I am interested in learning about engineering.					
v.	I generally have fun when I am learning about engineering or practicing engineering skills.					
w.	I like doing engineering activities or using engineering skills.					
x.	I know how to apply engineering concepts in my daily life.					
y.	I know how to identify and solve problems using engineering.					

6) The next question asks about <u>your views towards engineering and early childhood education</u>. How much do you agree with the following statements? (Please mark one answer per statement.)

		Completely disagree	Disagree	In the Middle	Agree	Completely agree
p.	I think that engineering is worth studying.					
q.	I believe that learning engineering ideas and skills is good for young children.					
r.	I think engineering skills will be useful for children's careers.					
s.	I think engineering ideas and skills will be useful for children in school.					
t.	It is important for Head Start children and their families to learn about engineering.					
u.	I want Head Start children and their families to learn engineering skills.					
v.	I think it is necessary to learn engineering as early as possible.					
w.	I would like Head Start children and their families to learn engineering, but the school day is already too full to include this topic.					

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7) This question asks about <u>your confidence with engineering</u>. How much do you agree with the following statements? (Please mark one answer per statement.)

	Completely disagree	Disagree	In the Middle	Agree	Completely agree
n. I am comfortable talking with preschool children and their families about engineering.					
o. I am comfortable doing engineering-related activities with preschool children and their families.					
p. I know how engineering is different from science.					
q. I know how to teach engineering skills to preschool children and their families.					
r. I know how to help preschool children and their families develop their engineering ideas and skills.					
s. I know how to find more engineering information to help Head Start children and their families.					
t. I know where to search to find more information about engineering.					

8). What are other ways you think engineering is valuable or relevant for you or Head Start families?

_____

_____

_____

9). We are trying to improve our surveys for the future. Was there anything about this survey that didn't make sense or you think could be improved?

_____

_____

_____

10). Anything else you'd like to share with the Head Start on Engineering project team?

_____

_____

_____

Thank you!

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APPENDIX J: Head Start Staff Online Monthly Journal Form

HSE 2.0 Monthly Journal

1. Name:

2. Location:

3. Month:

4. What have you done with Head Start children or families this month related to the HSE project (e.g., classroom activities, conversations with families, meetings with staff, etc.)? Please include details about the type and number of activities, experiences, or conversations.

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5. How often did you do the following in the last month? (Please mark one answer per statement.)

	Never	Once a month or less	Several times a month	Several times a week	Once a day or more
Talk about the HSE activities or program with another staff member.	○	○	○	○	○
Talk about the HSE activities or program with a Head Start family.	○	○	○	○	○
Use the Fox and Hen activity in the classroom.	○	○	○	○	○
Use the Mouse Run activity in the classroom.	○	○	○	○	○
Use the Bubble Wands activity in the classroom.	○	○	○	○	○
Use the Bird Nest activity in the classroom.	○	○	○	○	○
Use one of the HSE activities with Head Start families or children outside the classroom.	○	○	○	○	○
Read one of the books from the HSE activity boxes with Head Start children or families.	○	○	○	○	○

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Use the words "engineer" or "engineering" with Head Start children and families.	◯	◯	◯	◯	◯
Find new ways to use the HSE activity kits, such as adding new materials or creating new challenges.	◯	◯	◯	◯	◯
Create new activities or find new resources related to engineering for Head Start children or families.	◯	◯	◯	◯	◯
Incorporate the engineering design process into activities or experiences for Head Start children or families.	◯	◯	◯	◯	◯

6. Do you have any questions or comments for the HSE team at this point?

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Thank you!

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