

GOODMAN RESEARCH GROUP, INC.
Program Evaluation • Consultation • Market Research

*Communities of
Learning for Urban
Environments and
Science (CLUES)
Program*
**Final Summative
Evaluation Report**

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TABLE OF CONTENTS

Acknowledgements.....	3
Executive Summary.....	4
Introduction.....	7
Goals of the CLUES Program.....	7
CLUES Funding and Programming.....	8
GRG’s Evaluation of the CLUES Program.....	11
Methods.....	13
Evaluation Design.....	13
Procedures.....	13
Results.....	16
Implementation of CLUES Program.....	16
Apprentice Placements.....	16
CLUES Events and Activities.....	17
Apprentice Activities.....	20
Demographics of Populations Served by CLUES.....	21
Short-Term Outcomes of CLUES Program.....	26
Families.....	26
Apprentices.....	30
Presenters.....	37
Stakeholder Assessments of the CLUES Program.....	39
Families.....	39
Apprentices.....	40
Presenters.....	43
Community-Based Organizations (CBOs).....	46
Museum Partners.....	49
The Future.....	53
The Legacy of CLUES.....	53
The Future of Similar Programs at the CLUES Organizations.....	54
Takeaways and Lessons Learned for Other Organizations.....	56

Summary and Conclusions 60
 Implementation of CLUES Program 60
 Short-Term Outcomes of CLUES Program 62
 Stakeholder Assessments of the CLUES Program 65
 The Future 67

List of Appendices 68
 Appendix A: Annotated Family Baseline Survey 68
 Appendix B: Annotated Family Year-End Survey 68
 Appendix C: Annotated Apprentice Baseline and Year-End Surveys 68
 Appendix D: Annotated Presenter Year-End Survey 68



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Finally, we thank the CLUES museum partners and community-based organization partners, who made time in their busy schedules to talk with us about their experiences in CLUES.

EXECUTIVE SUMMARY

In the Communities of Learning for Urban Environments and Science (CLUES) project, the four museums of the Philadelphia-Camden Informal Science Education Collaborative worked to build informal science education (ISE) capacity in historically underserved communities. The program offered comprehensive professional development (PD) to Apprentices from 8-10 community-based organizations (CBO), enabling them to develop and deliver hands-on family science workshops. Apprentices, in turn, trained Presenters from the CBOs to assist in delivering the workshops. Families attended CLUES events both at the museums and in their own communities. The events focused on environmental topics that are especially relevant to urban communities, including broad topics such as climate change and the energy cycle to more specific topics such as animals and habitats in urban neighborhoods. CLUES was funded by the National Science Foundation, with additional funding by the Institute of Museum and Library Services.

Goodman Research Group, Inc. conducted external process and outcomes evaluation throughout the CLUES program's operation. GRG's process evaluation focuses on the implementation of the family science education programs and the Apprentice and Presenter PD activities and on outcomes including family science knowledge and engagement as well as Apprentice and Presenter science knowledge, ISE skills, and interest in ISE.

METHODS

GRG's research design for Y4 of the CLUES program included focus groups with families and Apprentices, baseline and year-end surveys of families and Apprentices, year-end surveys of Presenters, and year-end interviews with CBO and museum partners. In addition, during two site visits, GRG evaluators met with and observed Apprentices, Presenters, CBO and museum partners, and CLUES families in a variety of formal and informal settings, including Apprentice PD and museum floor work, a Presenter orientation meeting, a large museum event, a CBO workshop, and a monthly partner meeting. Because programming continued during Y5 as part of a no-cost extension, staff continued to collect year-end surveys and Family Information Forms from families attending CLUES events.

Response rates for Apprentices were perfect, with the exception of the first focus group, where several had scheduling conflicts. Museum and CBO partners were quite responsive as well (88% for each). Close to three-quarters of Presenters completed year-end surveys. CLUES staff ensured families filled out Family Information Forms (FIFs) and baseline surveys, but reasons, the response rate for the family year-end survey was rather lower (36%), so we urge caution in making comparisons between baseline and year-end data.

KEY FINDINGS

- In Y4 and Y5, there were 4,327 documented visits to nine large museum events and ten museum workshops and 851 documented visits to 63 community workshops. In total, 724 families made 1,198 visits to CLUES events; the average family group included about two adults and two to three children.
- Over the five years of the CLUES program, there were 17,720 documented visits to 24 large museum events, 34 museum workshops, and 327 CBO workshops.
- Most of the families (86% at baseline) belong to racial or ethnic groups historically underrepresented in STEM fields. CLUES drew families who were not necessarily already interested in science: Only about a third participated weekly or more often in science-related activities as baseline. As in prior years, the top three reasons they attended CLUES events in Y4 and in Y5 were to do something as a family, learn about science, and have fun.
- In Y4 and in Y5, significantly more families were knowledgeable about urban environmental topics after participating in CLUES. This gain was especially great for families who attended three or more events in Y4. Gains were dramatically higher in Y4 and, to a slightly lesser extent, Y5 of CLUES than they were in Y1.
- Families rated Y4 and Y5 CLUES events and the Y4 take-home activities as helpful in exploring environmental issues in their neighborhoods and continuing science learning at home.
- Y4 Apprentices made substantive gains in ISE skills, environmental science content knowledge, and skills at training and coaching Presenters. Two-thirds say they *probably* or *definitely* will continue in ISE.
- Y4 Presenters made substantial gains in ISE and presentation skills and in environmental science content knowledge. The majority reported greater interest in science, teaching about science, and science careers. Three-quarters say they *probably* or *definitely* will continue in ISE.

KEY TAKEAWAYS

- The CLUES program has had a lasting impact in creating and sustaining strong partnerships among museums and CBOs.
- The museums have other ISE programs, including some focused on environmental science, and they are committed to outreach to underserved communities.
- Several CBOs have a strong commitment to continuing similar programming. For others, there is inadequate funding or their mission is not as well aligned with this type of work.
- The museum and CBO partners shared some important lessons learned for other organizations:
 - Create strong and non-hierarchical museum-community partnerships. Communication is key to creating and sustaining these mutually beneficial and complementary partnerships.
 - Be thoughtful in designing family programming. It is important to meet families where they are and to ensure that content is relevant and useful to them.
 - Ideas to enhance recruitment include enlisting participating families to help, creating comprehensive contact lists, and having a familiar face representing the program to families.
 - To enhance CBO capacity to deliver family science programming in the future, workshop materials and lesson plans should be left with them.

INTRODUCTION

The Communities of Learning for Urban Environments and Science (CLUES) project was created and implemented by the four museums of the Philadelphia-Camden Informal Science Education Collaborative (PISEC): The Academy of Natural Sciences (ANS) of Drexel University, the Franklin Institute Science Museum (TFI), the New Jersey Academy for Aquatic Sciences (NJAAAS), and the Philadelphia Zoo. The PISEC partners, in collaboration with local community-based organizations (CBOs), have worked for almost 25 years to bring informal science education (ISE) experiences to families in underserved urban communities.

As with previous PISEC projects,¹ CLUES was designed primarily to increase science learning opportunities for families from historically underserved communities; in this case, with a topical focus on urban environmental issues. A further goal was to build community capacity for ISE. To this end, for four program years, CLUES provided comprehensive PD and floor work opportunities to Apprentices selected from the communities served by the partner CBOs.² By the end of their training, the Apprentices were developing and delivering hands-on family science workshops in their communities with the assistance of Presenters from their CBOs.

GOALS OF THE CLUES PROGRAM

The goals of the CLUES program were to:

1. Increase underserved families' interest in, understanding of, and engagement with science through hands-on science experiences that speak to families' interests and are relevant to their lives...[including] numerous STEM events, workshops, and outdoor projects...at home, in museums, and in the community.
2. Build and support informal STEM leadership in underserved communities so that each CBO will have the capacity to continue developing and presenting STEM programs. Apprentices and Presenters will gain knowledge, confidence, and skills to take on increasingly complex and independent planning and teaching responsibilities.
3. Explore and disseminate a new model for community outreach and capacity building for the museum and CBO communities and, in so doing, expand and enhance opportunities for community/museum collaboration.

“If you ask the people who are truly invested in the partnership, they will say they are honored to be a part of PISEC, rather than it just being something they have to do as part of their job.”
–Museum Partner

1 Past PISEC projects include The Family Learning Project, Community Connections, Families Exploring Science Together (FEST), Community Ambassadors in Science Exploration (CASE), and Building Museum/Community Partnerships (Bridges Conference).

2 During the first two program years, there were 10 CBOs. In Program Year 3, a new CBO (Creative Kids Club) joined, and in Program Year 4, two CBOs (Puerto Rican Unity for Progress and Youth Service, Inc.), were no longer funded.

CLUES FUNDING AND PROGRAMMING

The CLUES program was administered by NJAAS and funded primarily by a five-year grant³ from NSF's Advancing Informal STEM Learning (AISL)⁴ program, with an additional three-year grant from IMLS, which was extended into a fourth year. The grants supported a great deal of ISE programming for families, both directly and indirectly.

The NSF grant covered 28 hours per week of professional development (PD) in ISE for the Apprentices during each program year. Additionally, NSF funded one large-scale museum event annually, with hosting responsibilities rotating among the four museum partners, as well as two smaller museum workshops annually at each museum, for a total of one large event and eight smaller workshops each year.

For the first three program years, IMLS funded two additional Apprentices, for a total of 10, along with eight extra hours per week of environmentally focused PD for all Apprentices, bringing them up to full-time pay and hours. IMLS also funded a large-scale environmentally focused event at each museum annually, as well as quarterly networking events.

Beginning in program Year 4 (Y4), once IMLS funds were expended, Apprentices for Puerto Rican Unity for Progress (PRUP) and Youth Service, Inc. (YSI) were no longer funded; however, PRUP and YSI families were still welcome to attend CLUES events and workshops. Further, in the final year of the program, Apprentice PD was covered at the NSF-funded level of four days per week instead of five, as in previous program years.

In addition to the five large museum events and eight smaller museum workshops each year, the Apprentices were tasked with developing and presenting three sets of hands-on family workshops with take-home activities on three different topics, for a total of nine workshops presented at their CBOs.

With a no-cost extension, the CLUES programming extended into a Program Year 5 (Y5), with five additional museum events held between November 2014 and May 2015.

³ There was a six-month planning period at the beginning of the grant, and there will be a six-month wrap-up period at the end. Thus, programming years are offset six months from grant years. For example, Program Year 1, when the first cohort of Apprentices and Presenters started the program, occurred during the second half of Grant Year 1 and first half of Grant Year 2. Throughout this report, unless otherwise specified, we refer to Program Year 4.

⁴ This NSF program was named Informal Science Education (ISE) at the time the grant was first funded.

The Apprentice cohorts were selected by the PISEC museums and CBOs and were composed as follows:

- Cohort 1 consisted of Apprentices from 10 CBOs, all of whom stayed for two years of ISE PD in PY1 and PY2.
- Cohort 2 consisted of three Mentors selected from Cohort 1 and seven new Apprentices. Together, they represented the original 10 CBOs during program Y3. Families from two additional CBOs attended CLUES programming, but did not have Apprentices of their own.
- Cohort 3 consisted of new Apprentices representing eight of the CBOs remaining in PY4. Again, families from two additional CBOs attended CLUES programming, but did not have their own Apprentices.

As in prior years, PD for Apprentices involved:

- Receiving formal training in science topics, pedagogy, and ISE conducted by museum ISE staff and relevant outside experts,
- Gaining experience assisting professional and volunteer ISE staff in their assigned museums, and
- Acting in a leadership role in training and mentoring one to two Presenters from their own CBO to provide accessible family education programs on neighborhood environmental issues.

With each succeeding program year, the PD became increasingly focused on particular workshop topics as well as on practical guidance and feedback around workshop development and presentation. In Y4 in particular, the PD was “front loaded” to ensure that relevant science content was comprehensively covered before Apprentices began designing their own workshops. Further, there was a special emphasis in the final program year on “opening up” the workshops; that is, maximizing opportunities for family participation and moving from Apprentices’ comfort zone of lecturing to a more inquiry-based model emphasizing audience discovery.

“It’s always great for CLUES folks to talk about the CLUES program as much as they can, how it serves people from urban communities. People from urban communities, when they see someone they know, or from their neighborhood, or who looks very similar to how they look, that opens them up to, ‘Maybe I could do that.’”
–Former Apprentice

There were eight partner CBOs in Y4, with two additional CBOs receiving programming but not providing Apprentices or Presenters. The role of the primary CBOs was to select (or, in some cases, approve) Apprentices and Presenters, to assist at and help publicize CLUES museum events, to help Apprentices and Presenters schedule and publicize family workshops, and to attend monthly meetings with the CLUES museum team. The partner CBOs include several charter schools, a church, and a variety of community organizations:

- Congreso de Latinos Unidos (Congreso)
- Falomi Club/Camp Fire USA (Falomi)
- Folk Arts – Cultural Treasures Charter School (FACTS)
- Imani Education Circle Charter School (Imani)
- Indochinese-American Council (IAC)
- Leadership, Education, and Partnership Academy Charter School (LEAP)
- Norris Square Neighborhood Project (NSNP)⁵
- The African Episcopal Church of St. Thomas (St. Thomas)⁶
- As noted above, families from PRUP and YSI, which had CLUES Apprentices in prior years, were invited to museum events as well.
- Finally, families from Creative Kids Club (CKC)⁷ and North Camden Neighborhoods (NCN)⁸ also attended CLUES programming.

⁵ The NSNP Apprentice was terminated from the program before all of the CBO workshops were held. However, families were welcome to attend museum events and workshops.

⁶ The St. Thomas Apprentice left the program before holding workshops; however, the St. Thomas Presenters had significant experience with PISEC programs and were able to step up to develop and deliver the CBO workshops at St. Thomas.

⁷ CKC did not have its own Apprentice or Presenters, but CKC families were able to attend CLUES programming at the museums and at their own locations.

⁸ As with CKC, NCN did not have its own Apprentice or Presenters, but NCN families were welcome to attend CLUES events and workshops.

GRG'S EVALUATION OF THE CLUES PROGRAM

Goodman Research Group, Inc., a Cambridge, Massachusetts research firm specializing in the evaluation of educational programs, materials, and services, conducted external process and outcomes evaluation of the CLUES program. GRG's process evaluation focused on the implementation of the Apprentice and Presenter PD activities and the CLUES family science education programs. GRG also examined outcomes, including family knowledge of and connections to their urban environments; Apprentice and Presenter knowledge, skill, confidence, and interest in ISE; and, to a lesser extent, ISE capacity in the communities.

The evaluation was designed to focus on family outcomes primarily in the first and last program years, whereas evaluation activities focused on Apprentice, Presenter, and museum and CBO partner outcomes in all four years. This report describes the evaluation during Y4 and Y5 of the CLUES project's operation as well as reflecting back on the CLUES program as a whole. Process questions included:

- Do the family science events — including large museum events and museum and CBO workshops — unfold as designed? Are they interesting and relevant to families? In what ways do the family offerings build their awareness of and engagement in science?
- Are the PD and training for Apprentices and Presenters implemented as designed? How do the programs operate to produce ISE practitioners, and in what ways does CLUES encourage Apprentices and Presenters to become ISE practitioners?
- Which programmatic aspects of CLUES give Apprentices the most knowledge, skill, and confidence in developing workshops, training Presenters, and co-facilitating workshops?
- How much does the program vary from museum to museum and from CBO to CBO? How can the program be improved?

Outcome questions include:

- Does participation in CLUES activities increase family members' interest in, understanding of, and engagement with science?
 - Do families experience a shift in the extent to which they find science learning enjoyable and/or a worthwhile family experience?
 - What do underserved families in the Philadelphia-Camden region learn about their urban environments as a result of their participation in CLUES?
 - Does participation increase participating families' connections to their urban environment?
 - Do they become more active in addressing problems in their urban environment?
- Does the capacity of participating CBOs increase during the course of the program?
 - Do Apprentices complete the PD program with increased knowledge, enhanced skills, and greater confidence in developing and delivering workshops and in training and working with Presenters?
 - Do Presenters complete the training with increased knowledge, enhanced skills, and greater confidence?
 - Do Apprentices and Presenters gain greater interest in ISE practice? In what ways do they demonstrate their interest?
- Does the project result in a deliverable of best practices that will support museums and ISE communities to carry out community outreach?

METHODS

EVALUATION DESIGN

GRG’s research design for Y4 of the CLUES program included focus groups with families and Apprentices, baseline and year-end surveys of families and Apprentices, year-end surveys of Presenters, and year-end interviews with CBO and museum partners. As noted above, year-end family surveys continued during Y5. In addition, during two site visits, GRG evaluators met with and observed Apprentices, Presenters, CBO and museum partners, and CLUES families in a variety of formal and informal settings, including:

- PD activities (Apprentices, ISE staff, and museum partners),
- Orientation meeting (Presenters),
- Museum floor work (Apprentices),
- Large museum event (families, museum and CBO partners, Apprentices, Presenters),
- CBO workshop (families, Apprentices, Presenters, CBO and museum partners),
- Monthly partner meeting (CBO and museum partners), and
- Informal discussions (museum and CBO partners, ISE staff, Apprentices, families).

PROCEDURES

The table below shows the schedule of Y4 and Y5 evaluation activities and the response rate for each. These activities are described in further detail beneath the table.

Table 1.
Y4 and Y5 Evaluation Activities, Schedule, and Response Rates

	Completed	Participated/ Invited	Response Rate
Apprentices^a			
Baseline survey	Mar 2013	8/8	100%
F2F focus group	Aug 2013	3/8	38%
Virtual focus group	Mar 2014	6/6	100%
Year-end survey	Apr 2014	6/6	100%
Presenters^b			
Year-end survey	Apr 2014	8/11 ^c	73%
Families^d			
Y4, Y5 Family Info Form	Jun 2013-Apr 2014, Nov 2014-May 2015	916+282=1,198	unknown
Baseline survey	Jun-Jan 2013	724	unknown
F2F focus group	Aug 2013	7	n/a
Y4 year-end survey	Feb-Mar 2014	142	20%
Y5 year-end survey ^e	Nov 2014-May 2015	282	36%
CBO Partners			

Year-end phone interview	Apr 2014	7/8 ^f	88%
Museum Partners			
Check-in calls with NJAAS	Monthly	n/a	
Year-end phone interview	Apr 2014	7/8 ^g	88%
Observations^h			
Observation 1	Aug 2013	n/a	
Observation 2	Feb 2014	n/a	

^aTwo Apprentices left the CLUES program before the end of the year.

^bFive Presenters dropped out of the CLUES program before the end of the year.

^cOne Presenter from LEAP and two Presenters from St. Thomas did not fill out surveys.

^dApprentices and CLUES staff attempted to collect FIFs at all CLUES events the family attended and baseline surveys at a family's first event. Y4 year-end family surveys were collected at LEAP and Imani workshops and at a large NJAAS museum event. Y5 year-end surveys were collected at all five museum events.

^eY4 year-end surveys were anonymous, whereas Y5 year-end surveys were identifiable. Because it is impossible to know how many of the Y5 respondents had also filled out Y4 surveys, Y5 response rates are shown separately.

^fWe were unable to schedule an interview with the LEAP partner.

^gWe were unable to schedule an interview with one of two ANS representatives.

^hObservations involved Apprentices, Presenters, families, CBO partners, and museum partners.

As noted above, during Y4, GRG made two site visits, one in August 2013 and a second in February 2014. During the first site visit, GRG attended a large museum event and a Presenter orientation meeting at the Zoo as well as conducting two focus groups, one with CLUES families and the other with Apprentices. GRG also attended and participated in a PD session with Susan Holmes at TFI and observed the Apprentices working at TFI and ANS.

During the second site visit, GRG attended a monthly partner meeting with CBO and museum representatives at St. Thomas and a family workshop presented by an Apprentice and Presenter at LEAP. The next day's PD session and Apprentice focus group were cancelled due to inclement weather, so GRG held a virtual focus group with the Apprentices via Skype.

Paper baseline and year-end surveys were distributed to Apprentices by CLUES staff; Apprentices placed completed surveys in sealed envelopes before returning them to staff. The Apprentices distributed paper surveys to their Presenters; again, these were placed in sealed envelopes before being returned.

Paper baseline surveys were distributed to families at the first CLUES event they attended on a rolling basis throughout the year. Families were also asked to complete Family Information Forms (FIFs) at every event they attended during the year. GRG obtained 724 baseline family surveys and 1,198 FIFs, representing 1,198 separate family visits to CLUES events (some families attended multiple events).

Beginning in February, Apprentices and CLUES staff were to administer paper year-end surveys to families attending CBO workshops and museum events. There were CBO workshops scheduled at FACTS, IAC, Imani, and LEAP; however, only the Imani and LEAP Apprentices remembered to administer

family year-end surveys. CLUES staff did administer family surveys at a large museum event with 76 families in attendance. In Y5, CLUES staff administered paper year-end surveys to families attending the final five museum events.

Finally, year-end phone interviews were conducted with seven of eight CBO partners and with seven of eight museum partners.

The response rates for evaluation activities involving the Apprentices were perfect with the exception of the first focus group, where a number of Apprentices had scheduling conflicts. Museum and CBO partners were quite responsive as well, with 88% of each participating in phone interviews. Presenters were slightly more difficult to reach, although close to three-quarters completed year-end surveys.

CLUES staff made every attempt to collect FIFs from every family at each event and baseline surveys at each family's first event. To the extent they were able to do so, we assume there were approximately 724 CLUES families in Y4 and 282 in Y5. Thus, the response rate for family year-end surveys was 20% in Y4 and 36% in Y5. The Y4 response rate is somewhat lower than the 26% response rate in Y1, but as noted, some Apprentices did not distribute year-end surveys at their CBOs, and GRG did not provide the year-end surveys until the final large-scale museum event. In contrast, the Y5 response rate was quite a bit higher than in Y1. However, a response rate of 36% still suggests we exercise caution in making comparisons between baseline and year-end data, as the year-end sample likely consists of families who differ systematically from the baseline sample.

RESULTS

In this section, we first describe the implementation of CLUES Y4, including the placement Apprentices, the workshops and events that were held, and the population reached by CLUES programming. Next, we discuss short-term outcomes for the various constituencies of the CLUES program: families, Apprentices, Presenters, CBOs, and museum partners. The final section describes various stakeholders' assessments of the CLUES program and suggestions for improvement.

Quantitative and qualitative data addressing these areas come primarily from surveys and interviews, with additional qualitative data from focus groups and site visits. Annotated surveys showing all responses from families, Apprentices, and Presenters are displayed in Appendices A through D.

IMPLEMENTATION OF CLUES PROGRAM

Apprentice Placements

As noted above, Apprentices were selected by the museum partners in conjunction with the participating CBOs. In Y4, each museum hosted two Apprentices.

Table 2.
Y4 Apprentice Museum Placements

Museum Partner	Apprentice CBO
Academy of Natural Sciences of Drexel University ^a	▪ NSNP ▪ St. Thomas
The Franklin Institute	▪ Congreso ▪ Falomi
NJ Academy for Aquatic Sciences	▪ IAC ▪ LEAP
Philadelphia Zoo	▪ FACTS ▪ Imani

^aOne of these Apprentices left the CLUES program and the other was terminated early in the program year.

CLUES Events and Activities

In Y4, the museums held five large-scale events and eight workshops, as shown in the table below. In Y5, there were four large-scale events and one workshop. The approximate total number of visits to all of the museum events listed below was 2,832; because some families attended multiple events, this figure does not represent unique individuals.

Table 3.
Y4 and Y5 CLUES Museum Events and Workshops (10/01/12-04/30/15)^a

	Date	Attendance	
		Families	Individuals
ANS			
E: CLUES Family Day: Bug Fest	Aug 2013	66	277
E: Family Day at the Academy: Chocolate	Jan 2015	33	165
W: Dinosaur Workshop	Dec 2013	2	9
W: Animal Workshop	Jan 2014	10	37
W: Careers at the Academy Event	Apr 2015	17	60
TFI			
E: CLUES Family Day: Kitchen Science	Jul 2013	55	219
E: Color of Science	Mar 2015	55	202
W: SPY Workshop	Jun 2013	11	48
W: Cosmic Codes Camp-In Overnight	Mar 2014	16	89
NJAAS			
E: Fun with Frogs	Mar 2014	76	466
E: Deep Sleep Overnight	Mar 2014	19	86
E: May Event at the Aquarium	May 2015	42	139
W: Outdoor Wild Expo	Sep 2013	15	57
W: Sharks Workshop	Nov 2013	9	27
W: Frogs Workshop	Feb 2014	8	37
Zoo			
E: CLUES Family Day: KidZooU	Sep 2013	304	1,381
E: Family Day at the Zoo	Nov 2014	174	929
W: Polar Bears	Mar 2014	36	99
TOTAL		948	4,327

E = event; W = workshop.

^aMuseum events are on a calendar running from October 1, 2012 to September 30, 2013, whereas CLUES Program Y4 ran from April 1, 2013-March 31, 2014. Thus, events between October 1, 2012 and March 13, 2014 are shown above, along with Y5 events running from November 1, 2014-May 31, 2015.

During Y4, the Apprentices were to create and deliver three workshops, each held three times, for a total of nine per CBO. The six Apprentices who completed the program developed and conducted all of their required workshops, as shown in the table below. Although St. Thomas lost its Apprentice early on, that CBO's Presenters were experienced enough to take on responsibility for the workshops, so St. Thomas is included in the table below. In total, during Y4, 63 CBO workshops were conducted on 21 topics with 851 individuals in attendance. As

with the museum events described above, because some families attended multiple events, this figure does not represent unique individuals.

Table 4.
Y4 CLUES CBO Workshops (04/01/13-03/31/14)

	Dates	Attendance	
		Families	Individuals
<i>Congreso</i>			
Recycling ^a	Dec 2013	unknown	unknown
Defeat the Yummy Treats	Feb 2014	7	23
Things That Fly ^a	Mar 2014	unknown	unknown
<i>FACTS</i>			
Reduce-Reuse-Recycle to Save Polar Bears	Oct 2013	9	33
Monarch Butterflies	Jan-Feb 2014	5	17
Sumatran Tigers	Mar 2014	6	24
<i>Falomi</i>			
Trash! Trash! Trash! Why So Much Trash?	Oct 2013	8	43
Choo, Choo, Choo!! All Aboard!!	Jan-Feb 2014	16	24
I Am What I Eat	Feb-Apr 2014	53	125
<i>Imani</i>			
Africa's Animal Avengers	Sep 2013	9	28
Turtles, Terrapins, Tortoises...Oh My!	Nov 2013	12	36
Who Is That Big Cat?	Feb 2014	7	22
<i>IAC</i>			
Habitats	Oct/Nov 2013	23	56
Sustainable Seafood	Dec-Jan 2013-14	5	11
Sugar Water: Think About That Drink!	Feb/Mar 2014	14	32
<i>LEAP</i>			
My Home Is Your Home: Pinelands	Oct 2013	33	101
My Home Is Your Home: Wetlands	Dec 2013	28	88
My Home Is Your Home: Beach	Feb/Mar 2014	28	90
<i>St. Thomas</i>^b			
Overpackaging	Oct 2013	26	98
Other workshops ^c	??	??	??
TOTAL		289	851

^aFIFs for these workshops were not collected as only children attended.

^bThe St. Thomas Apprentice left the program before holding any CBO workshops; however, the St. Thomas Presenters had years' of experience and were therefore able to develop and deliver the CBO workshops there.

^cFIFs for these workshops were not returned to CLUES staff.

Over all five years of the CLUES program, there were 24 large-scale museum events, 34 museum workshops, and 327 workshops that took place at participating CBOs.

Table 5.
CLUES Events in Y1-Y4 and Y5

	Y1	Y2	Y3	Y4	Y5
Large Museum Events (N=24)					
ANS	1	1	1	1	1
TFI	1	1	1	1	1
NJAAS	2	1	1	2	2
Zoo	1	2	1	1	1
TOTAL	5	5	4	5	5
Museum Workshops (N=34)					
ANS	3	1	1	2	1
TFI	2	1	4	2	–
NJAAS	3	1	3	3	–
Zoo	1	3	2	1	–
TOTAL	9	6	10	8	1
CBO Workshops (N=327)					
Congreso	5	7	9	9	–
FACTS	9	9	8	9	–
Falomi	11	10	9	9	–
Imani	9	9	9	9	–
IAC	12	9	10	9	–
LEAP	11	9	9	9	–
NSNP	9	4	8	–	–
PRUP	8	9	6	–	–
St. Thomas	10	7	7	9	–
YSI	10	9	9	–	–
CKC	– ^a	1	4	–	–
TOTAL	94	83	88	63	–

^aCKC was not yet participating in CLUES in Y1.

Over the five years of CLUES, there is documentation for 17,720 individual visits to CLUES events. This number is likely to be an underestimate, as there were some difficulties with collecting paperwork in Y1. Y4 likely did have lower attendance than in prior years, as two CBOs (PRUP and YSI) no longer had assigned Apprentices, and two others (NSNP and St. Thomas) lost their Apprentices early on.

Table 6.
Families and Visits to CLUES Events in Y1-Y4 and Y5

	Y1	Y2	Y3	Y4	Y5	TOTAL
Families	668	–	–	724	290	–
Individual Visits	3,012	4,130	5,400	3,683	1,495	17,720
Family Visits	861	1,250	1283	916	321	4,631

Note: In Years 2 and 3, because we were not surveying families, individual families were not tracked. Thus, although we know how many individuals attended each event, we cannot link them together into family groups.

Apprentice Activities

To develop workshops, Apprentices reported looking to museum activities and PD sessions for inspiration, trying to select topics that would interest families, and tailoring the workshops to the families at their particular CBO:

Researched various topics with crafted activities that interest the community.

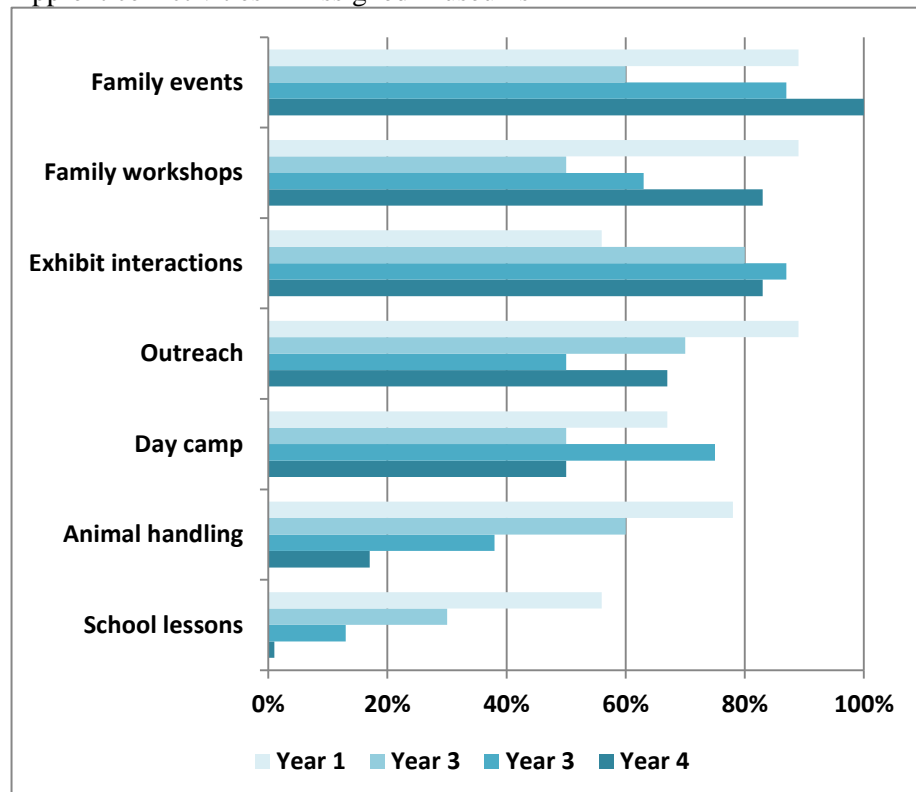
When I was in planning stages, I used resources from my museum to develop workshops about concepts we talked about.

...Some of the families did not speak English. For the ESL families, we incorporated a lot of pictures versus words.

Apprentices held practice sessions during PD sessions so they could get feedback from trainers and other Apprentices about what worked and what didn't.

As shown below, all Apprentices worked at family events. Most also did exhibit interactions (83%) and workshops (83%), and the majority did outreach (67%). Over the four years of CLUES, there were increases in family events and exhibit interactions and decreases in outreach, day camp, animal handling, and school lessons.

Figure 7.
Apprentice Activities in Assigned Museums in Y1-Y4



N=9 in Y1, 9 in Y2, 8 in Y3, and 6 in Y4

Demographics of Populations Served by CLUES

The table below shows the demographic characteristics of the Y4 Apprentices, Presenters, and CLUES families. Most of the Apprentices, Presenters, and families belong to racial or ethnic groups that have historically been underrepresented in STEM fields; that is, Black or African American and Hispanic or Latino/Latina. Two-thirds of the Apprentices and all of the Presenters were women, and 68% of the adults who attended CLUES events were women. However, adults brought approximately equal numbers of girls and boys to these events.

Table 8.
Y4 Personal Demographics of Different CLUES Constituencies

	Apprentices	Presenters	Family Visits	
Gender	(N=6)	(N=11)	(N=3,653 adult visits, 2,875 child visits)^a	
Female	66%	100%	Adults	82%
			Children	53%
Male	33%	–	Adults	18%
			Children	47%
Race/Ethnicity^b	(N=6)	(N=8)^c	(N=724)	
White	–	–	8%	
Hispanic, Latino/a	17%	–	45%	
Black, African American	67%	63%	50%	
Asian	17%	33%	6%	
Hawaiian, Pacific Islander	–	–	1%	
American Indian, Alaska Native	–	–	4%	
Other	–	17%	2%	

Note: We present percentages in this table to make it easy to compare results; however, please use caution in interpreting results based on a small number of surveys, where a difference of one or two surveys can produce a deceptively large difference in percentages.

^aIncludes data from Y5 in addition to Y4.

^bPercentages total more than 100% as respondents were asked to select all that apply. Race/ethnicity data were only available on the baseline family survey, which was only administered in Y4 and not in Y5.

^cNote that Presenter race/ethnicity data were only provided on the survey, and only eight Presenters responded to the survey.

The six Y4 Apprentices were strikingly diverse in terms of their ages and educational backgrounds. They ranged in age from 24 to 67 years old. All were fluent in English; two were also fluent in another language (Spanish and Khmer). In terms of education, one had a high school diploma, two had associates' degrees, two had bachelor's degrees, and one had a master's degree. Five had some background in science, technology, engineering, or mathematics and had developed and run family workshops. All had experience training, coaching, or mentoring others, and half had prior museum experience. Demographically, over

time, the percentage of women has increased since Y1, while the racial/ethnic distribution has remained similar.

The Y4 Presenters who took the survey were mostly young, with ages ranging from 16 to 30 (at least two of the non-responding Presenters were older). All six who took the survey are fluent in English, and three are also fluent in another language (Spanish, Cantonese, and Swedish). Two had prior background in STEM and past teaching experience, while only one had experience presenting workshops. As with the Apprentices, compared to Y1, the percentage of women has increased, while the racial/ethnic distribution has remained stable.

As noted above, in Y4 and Y5, at least 724 families made at least 1,198 visits to CLUES events.⁹ The average family group in both years included about two adults and two to three children. Eighty percent of the families who filled out FIFs in Y4 and Y5 had attended one CLUES event, while 20% had attended two or more (range: 1-10 events across the two years). A primary goal of CLUES is to increase historically underserved families' interest in, understanding of, and engagement with science; this includes bringing them to the PISEC museums as well as providing ISE events in their own neighborhoods. As shown in the table above, the families who attended CLUES events were primarily made up of such underserved families. Of the families, most (90%) speak English at home, 27% speak Spanish, and 4% speak another language, including Indonesian, Chinese, and Polish.¹⁰

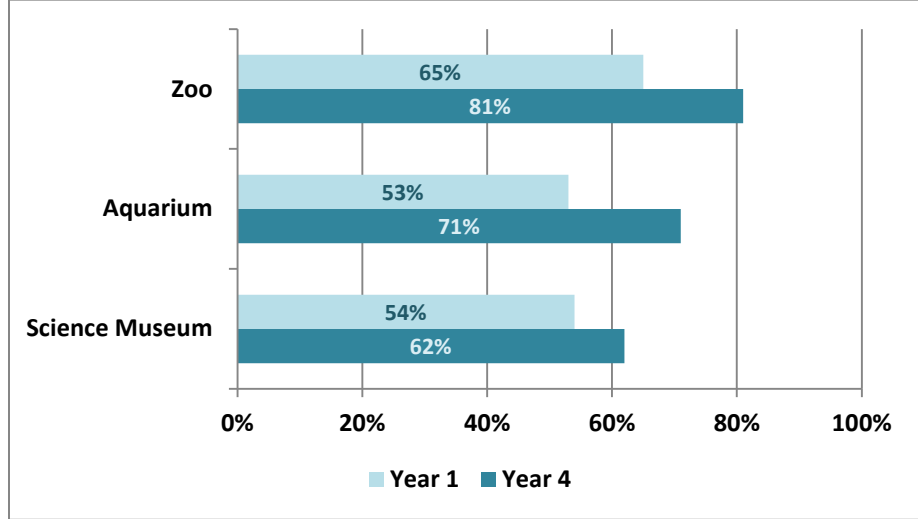
Over time, family demographics have remained consistent, with a similar gender breakdown of adults and children attending each year. Family race and ethnicity were last assessed in Y1, at which time the distribution was extremely similar to that seen in Y4.

Many of the Y4 CLUES families were no strangers to museums: Fully 81% had visited a zoo at least once per year before participating in CLUES, and the majority had visited an aquarium or a science museum with the same frequency. As shown in the figure below, the percentage of museum-attending families at baseline has grown since the first year of the CLUES program as families participate for multiple years.

⁹ Some 724 unique families filled out baseline surveys, and these families filled out 1,198 FIFs at CLUES events. It is possible that this figure may underrepresent CLUES families and family event attendance to some degree; however, as in prior years, CLUES Apprentices and staff worked hard to collect FIFs from all attending families at all events.

¹⁰ Percentages total more than 100% as respondents were able to select multiple options.

Figure 9.
Family Baseline Museum Attendance in Y1 and Y4



N=471-488 in Y1 and 312-346 in Y4

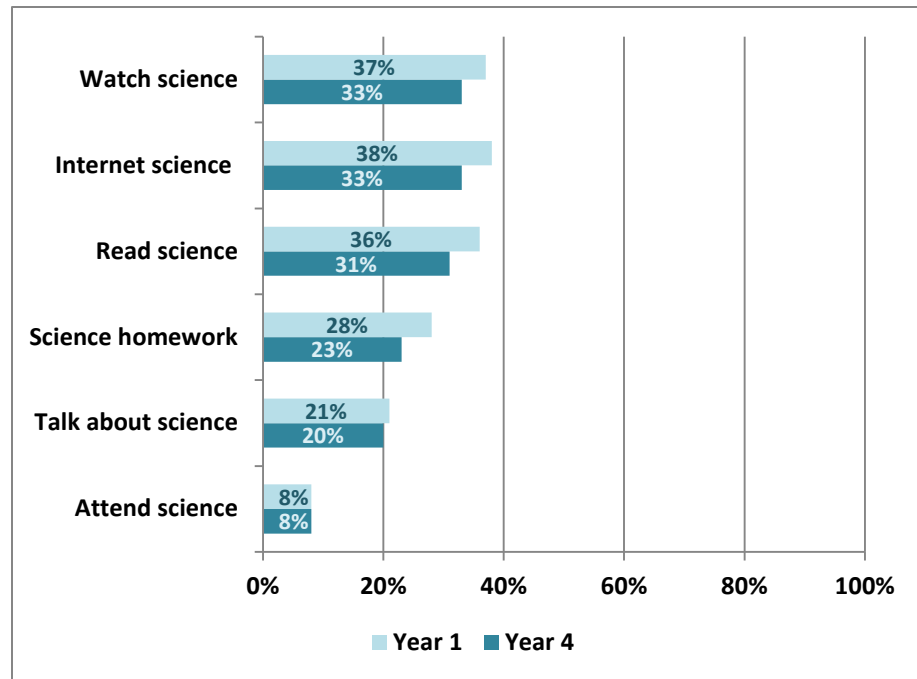
Note: Baseline surveys were only filled out in Y4 and not in Y5.

As in all three prior years of the program, the top three reasons Y4 and Y5 families reported attending CLUES events were to do something as a family (69%), to learn about science (61%), and to have fun (52%).

The Y4 families represented a wide range in terms of their participation in science-related activities at home at baseline, with roughly a fifth rarely participating and roughly a third often participating in such activities, defined as weekly or more often.

These baseline percentages are quite similar to what they were in Y1 when they were last assessed, although, interestingly, they were slightly lower in Y4. The figure below shows that the CLUES program was very effective at drawing families who were not necessarily already interested in science, and they seem to have become slightly more successful at this in Y4.

Figure 10.
Baseline of Frequent Family Participation in Science Activities in Y1 and Y4



N=483-506 in Y1 and 483-506 in Y4

Note: Baseline surveys were only filled out in Y4 and not in Y5. “Frequent” participation is defined as weekly or more often.

In Y4, at baseline, a number of families reported being quite knowledgeable about various environmental science topics that have particular relevance to urban neighborhoods, whereas smaller numbers of families reported being substantially less knowledgeable about these areas.

Table 11.

Y4 Baseline Family Understanding of Environmental Science Topics

	<i>No or Only A Little Understanding</i>	<i>Quite a Bit or A Great Deal of Understanding</i>
How to reduce, reuse, and recycle	14%	66%
Water pollution and water treatment	20%	58%
The food chain	18%	55%
Inner-city health issues (e.g., asthma, physical fitness)	19%	52%
Animals/habitats in your neighborhood	26%	44%
The energy cycle	34%	34%

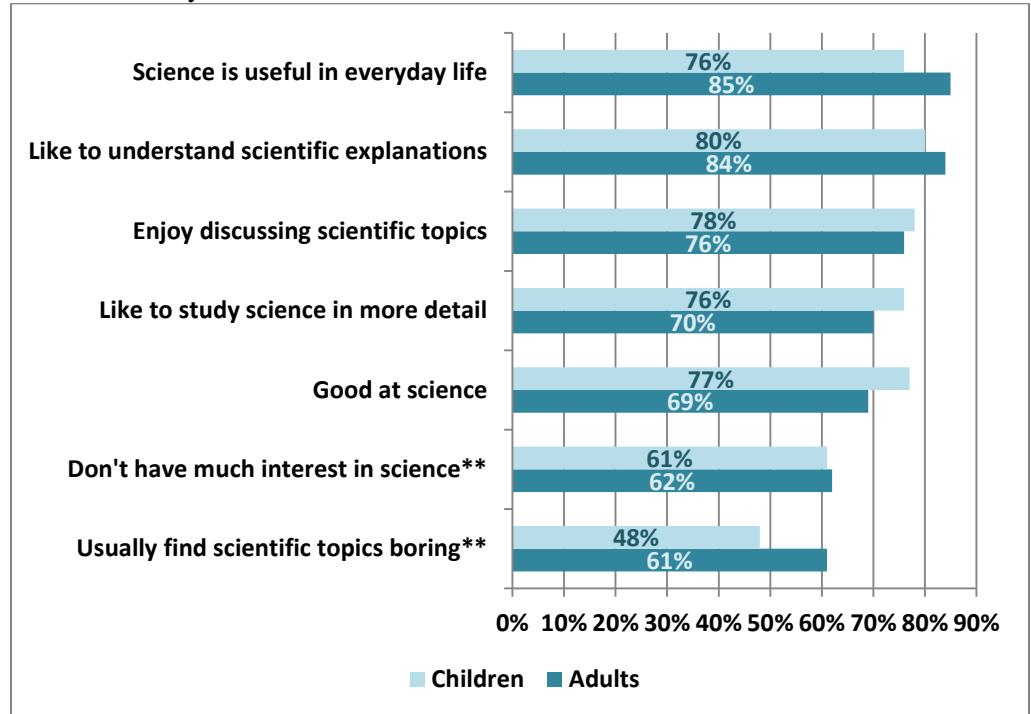
N=342-361

Note: Baseline surveys were only filled out in Y4 and not in Y5.

This level of baseline environmental science knowledge is similar to the levels measured in Y1, the last time family knowledge levels were assessed. There is one notable exception: In Y4, 15% more families report knowing *quite a bit* or *a great deal* about water pollution and treatment, which may indicate the influence of CLUES workshops from prior years.¹¹

Y4 CLUES families also reported quite positive attitudes toward science at baseline, as shown in the figure below.¹²

Figure 12.
Baseline Family Attitudes Toward Science in Y4



N=331-350

Note: Baseline surveys were only filled out in Y4 and not in Y5. Adults responded to these items on their own behalf and then on behalf of the children accompanying them. Positive attitudes are indicated by *strongly* or *sort of* agreeing with positive statements about science and *strongly* or *sort of* disagreeing with negative statements about science.

**These items were reverse scored.

¹¹ There was also a 12 percent gain in families who were knowledgeable about inner-city health issues, but different examples were given in Y1 (lead poisoning, asthma, TB, pneumonia) and in Y4 (asthma, physical fitness). This wording change may well account for the greater baseline knowledge reported in Y4.

¹² This scale was added in Y4, so there are no comparative data from Y1.

SHORT-TERM OUTCOMES OF CLUES PROGRAM

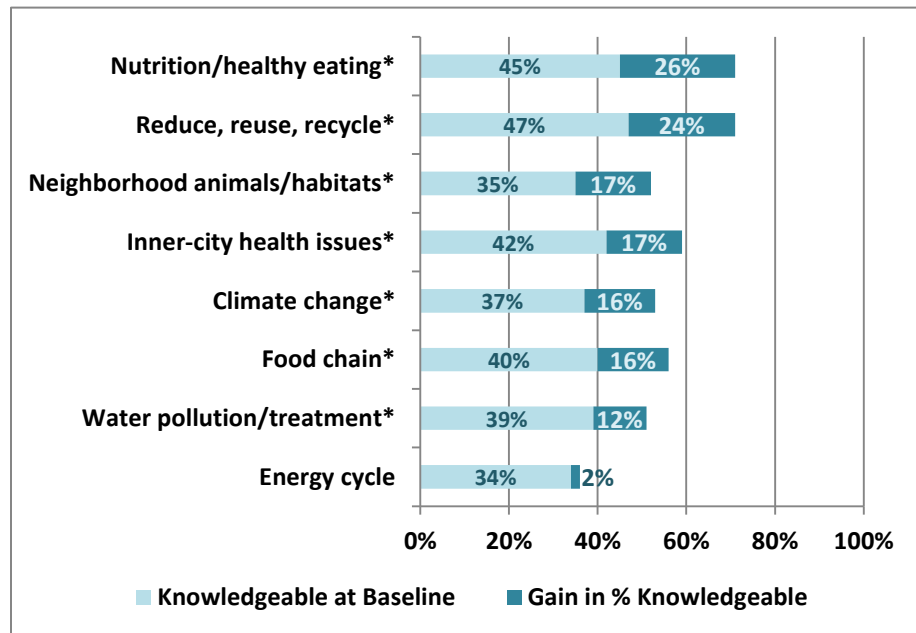
“The partnership of CLUES was great at bringing in families, exposing the families to different sciences. Parents would have conversations about how they didn’t know things before, which brings out the fact that they really internalized information and now are talking about it; it shows the impact.”
 –CBO Partner

Families

Knowledge of Environmental Science Content¹³

In Y4 and in Y5, on average, families showed a significant gain in their knowledge of the urban environmental topics addressed in CLUES educational events and workshops. As shown in the figure below, in Y4, these gains were also statistically significant on an item-by-item basis, with the exception of knowledge of the energy cycle. The self-reported gains were similar, though slightly smaller, in Y5. Averaging across topics, the gain was 16% in Y4 and 8% in Y5 — perhaps unsurprising given that most Y5 events were large-scale museum events.

Figure 13.
 Increased Family Knowledge of Environmental Science in Y4



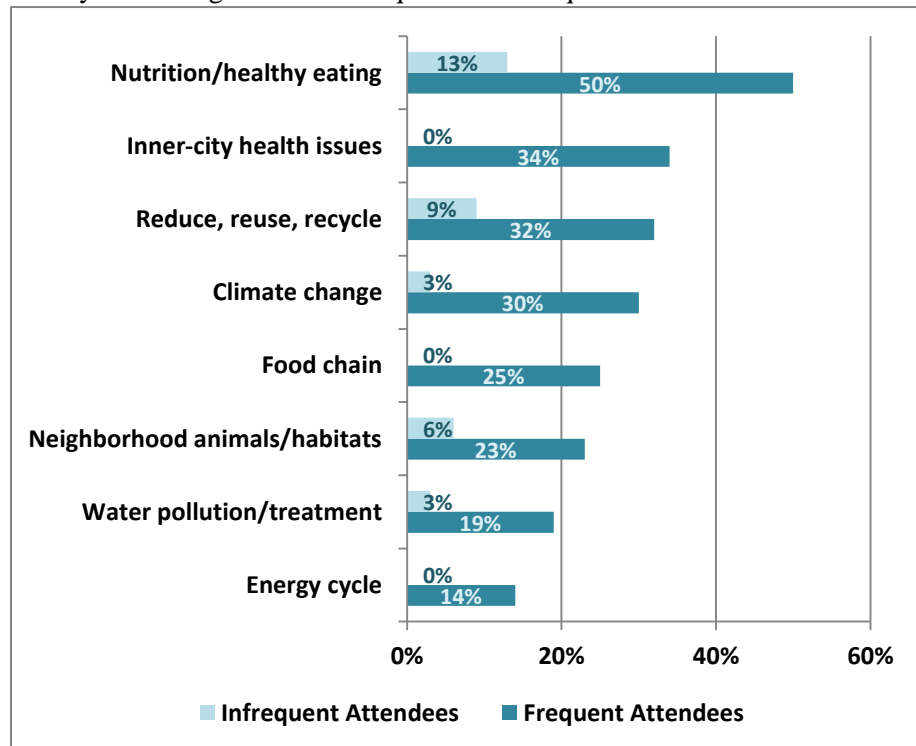
N=124-132 in Y4 and 255-269 in Y5

¹³ Note that there are two main ways to compute family knowledge gains: In the aggregate; i.e., comparing responses for the 724 families with baseline surveys to those with year-end surveys (Y4=142; Y5=282), or via direct comparison; i.e., matching families at baseline and year-end and testing change. However, due to the way Y4 year-end surveys were administered, it is not possible to match families. A third possibility is a compromise between aggregate and matched comparison. At year-end, families were asked to retrospectively rate their baseline knowledge. Retrospective pre-test (RPT) items like this are designed to account for response shift bias, a change in how respondents answer questions before and after a program due to a better understanding of the concepts afterwards; this can lead to unrealistically inflated ratings at baseline, before respondents understand what they don’t know. Therefore, to assess family knowledge gains, we compared year-end and RPT responses for the 142 Y4 families and 282 Y5 families.

Note: Bars show percentages of families who said they understood *quite a bit* or *a great deal* about each topic before (light section) and after (light + dark sections) CLUES. Thus, the dark section of each bar represents the gain in knowledge.
 *Means were significantly different at the $p < .05$ level.

In Y1, the last time GRG assessed family knowledge gains, we found a qualitative difference between frequent CLUES attendees — those who participated in three or more CLUES events — as compared to less frequent attendees. When we compared the same subgroups in Y4, we found very dramatic differences, as shown below.¹⁴

Figure 14.
 Family Knowledge Gains in Frequent vs. Infrequent Attendees in Y4



N=38 frequent, 41 infrequent

Note: Frequent attendees came to 3+ CLUES events in Y4, whereas infrequent attendees came to fewer. Bars show gains in the percentages of frequent vs. infrequent attendees who understand *quite a bit* or *a great deal* about each topic. Average gains were significantly different at the $p < .05$ level.

Further, frequent attendees were also significantly more likely to report awareness of environmental issues in their neighborhood than were infrequent attendees (67% vs. 37%); there was no such difference at baseline.

As noted, Y1 was the last time family knowledge gains were assessed. At that time, there were no significant gains from baseline to year-end knowledge of any

¹⁴ We were unable to replicate this finding in Y5. With only five events during this year, too few families had attended three or more — or even two or more — events to test the difference.

specific topics, and the frequent attendees only showed significant gains on three of the topics as compared to seven in Y4/Y5. Thus, family knowledge gains were dramatically higher in Y4 than they were in Y1.

It should be noted that in Y4, the measure of family knowledge of environmental science was shortened and tied more directly to workshop content. However, five items remained identical, and two are still substantially similar. The Y4 families made dramatic gains on these items as well, indicating a true difference in family learning during Y4 versus Y1. This is likely due to a combination of (a) better-designed workshops and events producing greater learning, and (b) the fact that Y4 families may have been attending CLUES events for multiple years, gaining cumulative knowledge of these environmental topics.

In terms of other topics, Y4 families mentioned several during an August 2013 focus group:

We learned to recognize different kinds of birds. We didn't know there were so many types right in the city!

That sharks need to keep moving, and at BugFest, we learned that we actually need bugs in order to survive.

We learned to make paper.

When asked about how the CLUES program has affected the children, parents and grandparents offered that it has sparked their interest in science as well as motivated some behavior change:

There's been a change in their interest in science. They make connections now with stuff they learned through CLUES.

They will do research on the Internet when we come back home after CLUES events to find out more information about what they learned. So the learning continues when we come home.

Our nutrition changed; we don't drink soda anymore, and we eat more whole wheat.

Usefulness of CLUES Events

Y4 and Y5 families were quite positive about how helpful these CLUES events were in allowing them to explore environmental issues affecting their neighborhoods. The majority (70%) found the CBO workshops *very* or *extremely* helpful, with somewhat greater percentages giving high ratings of the museum workshops (74%) and the large museum events (77%). These assessments were similar to those in Y1.

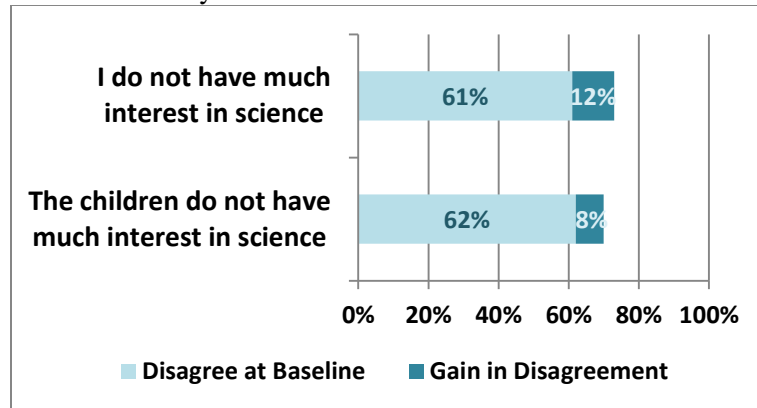
CBO workshops, which only occurred in Y4, had take-home activities. Almost three-quarters (74%) of families attending these workshops used the take-home activities. Averaging across all CBO workshops, the activities were rated as

somewhat above *very enjoyable* and *very helpful* in allowing families to continue science learning at home. Again, these assessments are similar to those made by families in Y1.

Engagement with Science

As shown in the figure below, after participating in CLUES programming, Y4/Y5 families showed significant gains in one aspect of science attitudes: Interest.¹⁵ The findings were similar in Y5, although they were only marginally significant ($p < .10$).

Figure 15.
Increased Family Interest in Science in Y4



N=339-349 families at baseline, 133-134 families in Y4, and 264-271 families in Y5
 Note: Bars show percentages of families who *disagreed* or *strongly disagreed* with the statement. Average gains were significantly different at the $p < .05$ level.

However, there were no differences at baseline versus Y4 or Y5 year-end in the frequency of families visiting science institutions¹⁶ or engaging in science-related activities such as reading or watching programs about science.

¹⁵ As noted earlier, this scale is new in Y4, so no comparative data are available from Y1.

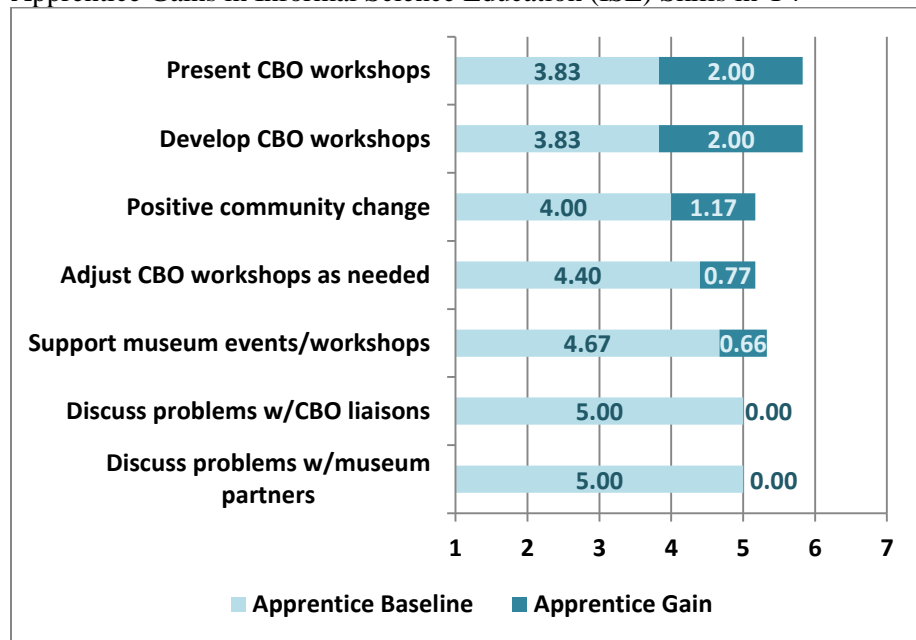
¹⁶ One exception was a Y4 increase in frequency of visiting the aquarium, but this likely reflects the fact that a large percentage of that year’s year-end family surveys were completed by families attending a large event at the aquarium.

Apprentices

Informal Science Education Skill Development

As shown in the light turquoise section of the bars below, before their CLUES training, the Apprentices rated even their highest-level ISE skills as two-thirds of a point above the midpoint on a 7-point scale from *beginner* to *expert*, on average. They improved in all of the ISE-related skills after their CLUES training, especially in the areas of developing and presenting CBO workshops. At the end of their training, Apprentices were rating themselves close to 6 on a 7-point scale in these areas.

Figure 16.
Apprentice Gains in Informal Science Education (ISE) Skills in Y4



N=6

Scale: 1 (beginner) – 7 (expert)

Note: Bars show mean Apprentice skill ratings at baseline (light turquoise) and at year-end (light + dark turquoise). Thus, the dark turquoise portion of each bar represents the gain in Apprentice knowledge after CLUES training.

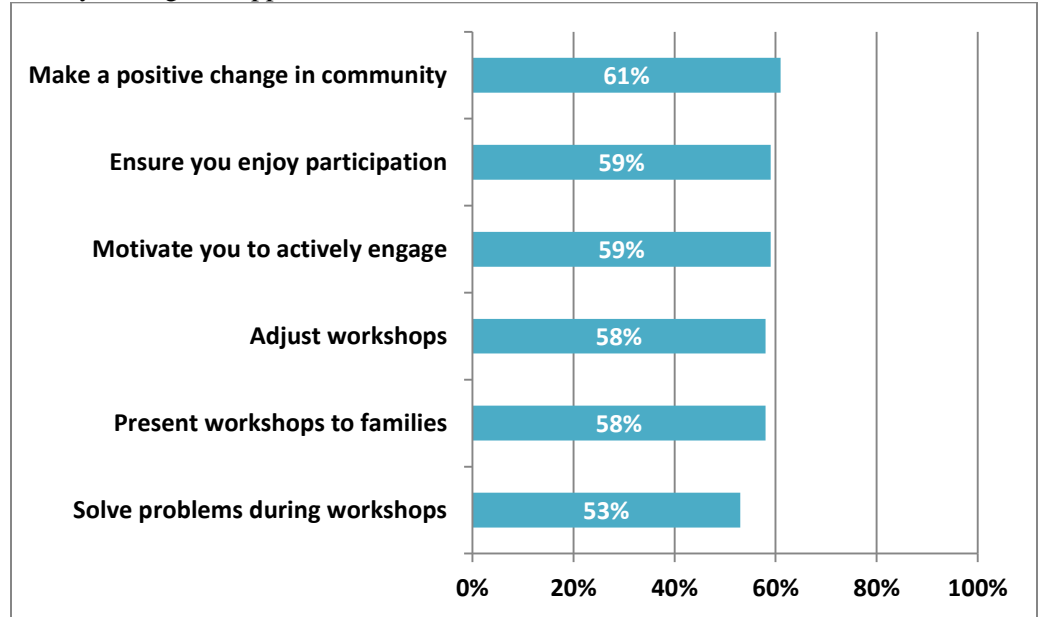
Of course, the Presenters are also in a position to assess Apprentice ISE skills. The eight responding Presenters agreed that their Apprentices were skilled at developing (100%),¹⁷ presenting (100%), and adjusting (88%) CBO workshops and at making a positive change in their communities (88%), giving them ratings of 5, 6, or 7 on a scale from 1 (beginner) to 7 (expert).

The CBO workshops were also well received by families, attesting to the ISE skills of the Apprentices delivering them. As shown in the figure below, the

¹⁷ Note that in some cases, results are presented as percentages in order to facilitate comparisons. However, it is important to note that with small Ns, as with the Presenters and the Apprentices, such percentages may be somewhat misleading.

majority of families assign a fairly high skill rating to their Apprentice or Presenter.

Figure 17.
Family Ratings of Apprentice/Presenter Skill Level in Y4

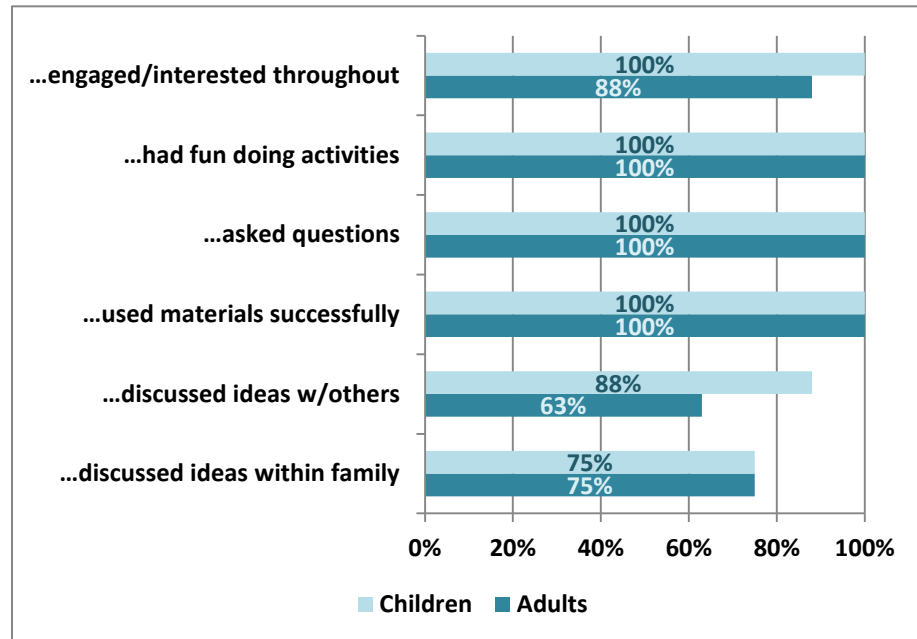


N=98-100

Note: Ratings come from Y4 families, as there were no Apprentices or Presenters in Y5. Bars show the percentage of families who rated the Apprentice as *skilled*, defined as a rating of 5, 6, or 7 on a scale from 1 (beginner) to 7 (expert).

Apprentice skills in developing and presenting workshops are also reflected in audience engagement. All eight Presenters (100%) *agreed* or *strongly agreed* that families found workshop participation worthwhile. When asked to assess the engagement of both children and adults at the CBO workshops they attended, they rated the workshops as fun and engaging for both groups, as shown in the figure below.

Figure 18.
Presenter Ratings of CBO Participant Engagement in Y4



N=8

Note: Bars show percentages who reported children and adults were engaged, defined as a rating of 4 or 5 on a scale from 1 (not at all) to 5 (to a great extent).

The CBO partners also discussed their Apprentices’ development over the course of their year of CLUES training, especially in terms of their presentation and interpersonal skills and their ability to connect with their communities in a deeper way. In terms of confidence, comments included:

[Apprentice] became a little more comfortable. She was really comfortable from the beginning, but she got even more so. She learned how to be succinct and how to handle the barrage of questions from the children! [laughs]

One CBO partner discussed what a change the CLUES Apprenticeship was from what her Apprentice had been doing before, and how she rose to the occasion:

She was excited. This was something totally different for her...Just in general, she was a little apprehensive, but she continued to work through it.

Two Apprentices were especially good at connecting with families at their CBOs:

[Apprentice] enjoys working with the community, and it’s a plus that he has the same background...He wasn’t too nervous about doing workshops with parents who don’t speak English well; he adjusted to it. He can speak on a level for laypeople in the community, but he still brings expertise.

I have seen changes in [Apprentice]. Her personality has been great for engaging families, and she has gone above and beyond in getting families enthusiastic. Parents would stop and stay longer to see [Apprentice]'s workshops. She not only engages CLUES families, but stays after school with another [CBO] program, going above and beyond.

Museum partners worked closely with the Apprentices in developing workshops and were able to comment even more extensively on their growth in this area:

I have seen growth; I saw [Apprentice] developing programs early on, and she started out with very broad topics and struggled with narrowing down topics to specific things, but she has improved greatly. Additional training opened her eyes to additional opportunities. She was able to decide on topics that were of interest and relevance to families.

[Apprentice] said she never pictured herself standing in front of a crowd and speaking. But she was willing to try, and made a lot of growth. Watching the shift with [several Apprentices], by modeling a questioning approach with them, they began to take it on and put it into action in their own workshops. I heard brilliant things coming out of all of them at the Frog Workshop. [Another Apprentice] has an existing understanding of how to organize things. Each Apprentice seems to have their own strength and has grown in their own direction.

Another noted that even the Apprentices who came in with excellent presentation skills were able to develop them further:

Both [Apprentices] came in with higher levels of speaking skills and science skills than the average Apprentice. [They] experienced growth, but not as much as the others, who had more room for growth. However, there was still an increase in their skills: They assessed what they used to do in the past, and looked at it differently in light of CLUES.

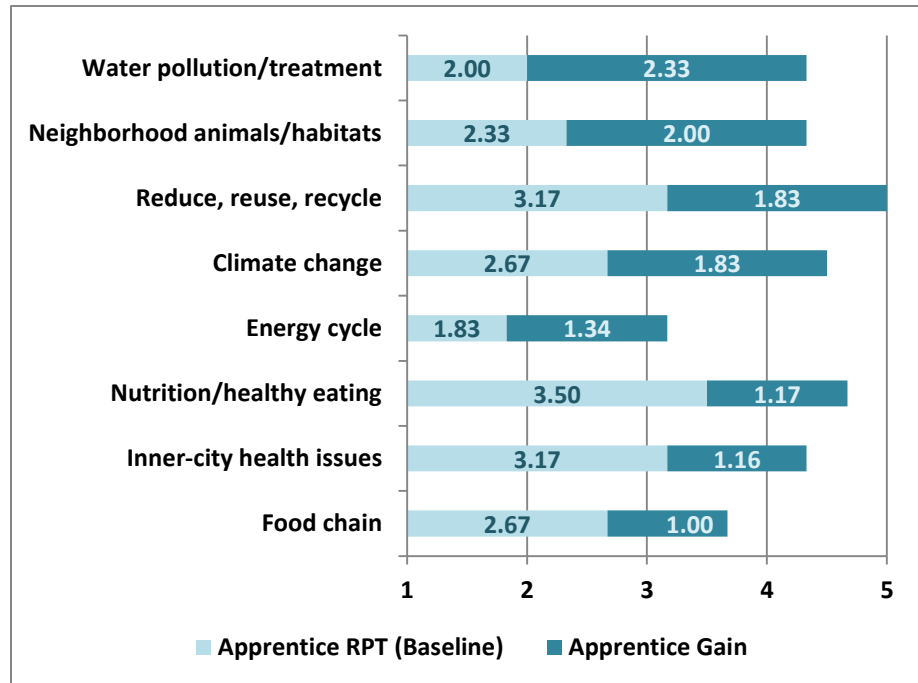
Another museum partner was struck by her Apprentices' enthusiasm and interest in pursuing ISE work professionally:

Oh, yes! Both [Apprentices] applied for jobs here and are eager to continue their informal science education and their affiliation with the museum. Both of them got hooked! They learned a lot and were very enthusiastic about their floor work. So their emotional engagement and identification was very strong.

Knowledge of Environmental Science Content

Apprentices made substantial knowledge gains in every area of environmental science assessed, as shown in the figure below. On average, Apprentices rated themselves as having between *only a little* and *some* knowledge of these topics before CLUES, versus just under *quite a bit of knowledge* afterwards. These gains were especially large in the areas of water pollution and treatment; neighborhood animals and habitats; how to reduce, reuse, and recycle; and climate change.

Figure 19.
Apprentice Gains in Knowledge about Environmental Science in Y4



N=5-6

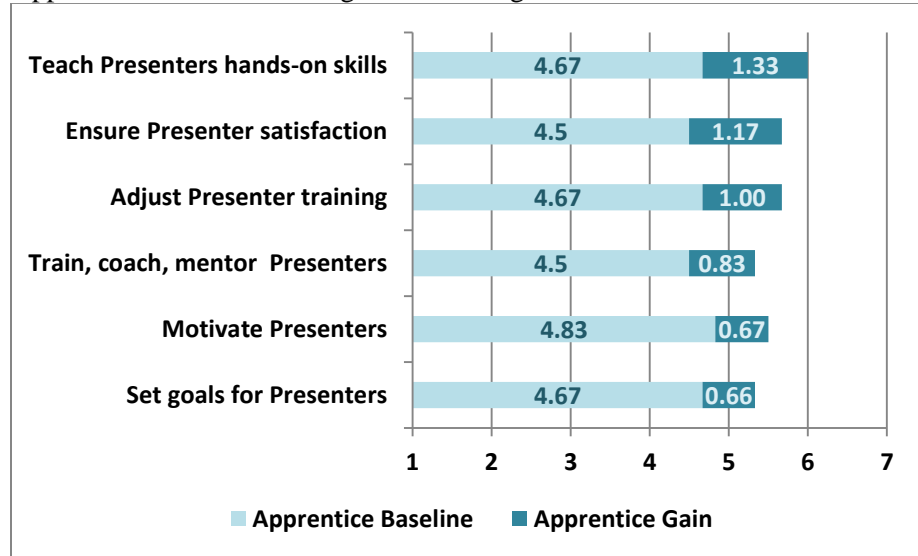
Scale: 1 (none), 2 (only a little), 3 (some), 4 (quite a bit), 5 (a great deal)

Note: RPT (retrospective pre-test) items asked Apprentices at year-end to retrospectively rate their knowledge before their CLUES training, knowing what they know now about those topics. As noted earlier, RPT items are designed to account for response shift bias, a change in respondent answers before and after an educational program because they have a better understanding of the concepts after participating in the program. The bias can lead to unrealistically inflated baseline ratings and, therefore, to underestimation of gains.

Training and Mentoring Presenters

Apprentices also reported substantive gains in their skills at training and mentoring Presenters, moving into the *skilled* range after a year of training, as shown below. These gains were especially notable for teaching hands-on skills, ensuring Presenter satisfaction, and adjusting their training when things were not going as planned.

Figure 20.
Apprentice Gains in Training and Coaching Skills in Y4



N=6

Scale: 1 (beginner) – 7 (expert)

Note: The bars above show mean Apprentice skill ratings at baseline (light turquoise) and at year-end (light + dark turquoise). Thus, the dark turquoise portion of each bar represents the gain in Apprentice knowledge after CLUES training.

Again, Presenters are also qualified to comment on their mentoring by the Apprentices. Most (88%) of the Presenters agreed that their Apprentices were skilled in all six of these areas, as indicated by rating their Apprentice’s expertise at 5, 6, or 7 on a scale from 1 (beginner) to 7 (expert).

Informal Science Education (ISE) Understanding and Plans

As shown in the table below, all or most of the Apprentices *agreed* or *strongly agreed* that participating in CLUES had led them to a better understanding of ISE, made them more confident of their ability to succeed in ISE, and led to a fuller exploration of their career goals.

Table 21.
Y4 Apprentice ISE Understanding and Plans

	Percentage of Apprentices Who Agree or Strongly Agree
My participation in this Apprenticeship led me to a better understanding of ISE	100%
My participation in this Apprenticeship makes me more confident in my ability to succeed in ISE.	83%
My participation in this Apprenticeship led to a fuller exploration of my own career goals.	83%

N=6

After participating in CLUES, two Apprentices said they *definitely will* and two more *probably will* continue in the ISE field through school or a job in the next year; the remaining two were undecided. When asked about their post-Apprenticeship plans, two explicitly mentioned continuing in science:

I plan to continue to learn and to teach others about science.

I hope to continue to develop my love for science into a career in a science-related environment.

Another wanted to work on behalf of the CLUES program specifically:

Network how the CLUES program is vital for families, administration [of the] school district, and recreational sites.

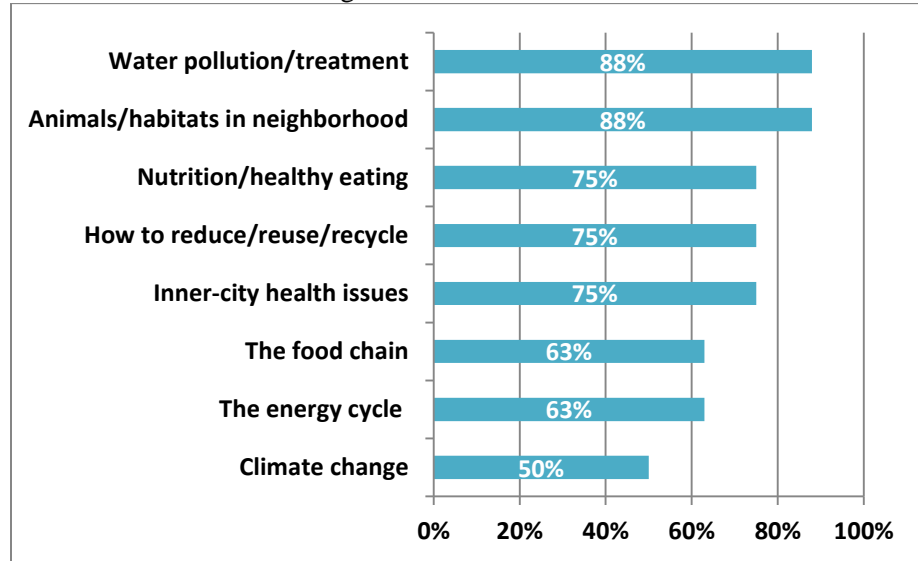
Presenters

Knowledge of Environmental Science Content

In Y4, the majority of Presenters reported substantial gains in their knowledge of environmental science topics as a result of their CLUES participation, especially the topics most relevant to CLUES workshops: neighborhood animals and habitats, water pollution/treatment, inner-city health issues, and how to reduce, reuse, and recycle.

Figure 22.

Presenter Gains in Knowledge about Environmental Science in Y4



N=8

Note: Figure shows percentage reporting their knowledge increased *quite a bit* or *a great deal*.

Informal Science Education Skills, Understanding, and Plans

In Y4, all responding Presenters *strongly agreed* that their CLUES participation led them to a better understanding of ISE (100%) and improved their presentation skills (100%). The majority also *agreed* or *strongly agreed* that participating in CLUES had increased their confidence in their ability to succeed in ISE (88%) and led to a fuller exploration of their career goals (88%).

Many of the responding Presenters are *very* or *extremely* interested in science and in teaching others about science, and just over a third are interested in a career in science. The majority indicate that these ratings represent increases in their interest in these areas, as shown in the table below.

Table 23.
Y4 Presenter Interest in Science

	Very or Extremely Interested	<i>A Little More or A Lot More Interested Now</i>
Science	88%	88%
Teaching others about science	63%	88%
A career in science	37%	63%

N=8

CBO partners noted growth in the Presenters over the course of their participation in the CLUES program in terms of their presentation, communication, and leadership skills:

Because of the complexity of the topics, [Presenter] did a much better job, and she planned well with [Apprentice]. She has learned fast and adjusts well for the audience. She and [Apprentice] seem more confident and have the power to adjust and react according to the audience, or where they do the workshops, etc.

[Presenter] was great; [the other Presenter] was great as well. In terms of personal development, they started to take more initiative and worked the crowd more confidently. Their leadership skills grew.

[Presenter] definitely grew; she was really good with crowd control and helping [Apprentice] out.

Three of the Presenters said they *definitely will* and three said they *probably will* continue in the ISE field through school or a job in the next year; two were *undecided*. Three Presenters said they *definitely would* and two said they *probably would* move on to Apprentice training if it were available; two were *undecided* and one would *probably not* move on to such training.

STAKEHOLDER ASSESSMENTS OF THE CLUES PROGRAM

“I think it was great in knowing that we can bring this information to families...Some families have a vested interest in our organizations now. If they didn’t come [for CLUES], they might not think of coming [to the museums]. So we build a presence in the community. Some of the families are just gushing; they come to multiple events, and it’s an important part of their life.”

–Museum Partner

The section below describes assessments of the CLUES program and suggestions for improvement from the program’s primary stakeholders: Apprentices, Presenters, CBOs, and museum partners.

Families

Families enjoyed CLUES events very much, with 74% rating the CBO workshops as *very* or *extremely* enjoyable. For the museum workshops and large events, the corresponding percentages were 80% and 84%.

During a focus group, parents and grandparents also reported that they really enjoy coming together as a family to learn new things about science through CLUES:

It gives us time for the family to bond and find time together, and it’s not just TV or games...It’s family time for science, and fun family events.

My son loves sharks, so when I took him to the shark workshop, he thought I was the best mom ever!

CLUES events help make learning at home easier; I can say, “Remember when you saw that at the Zoo?” She now seeks out information, and she pushes us to learn.

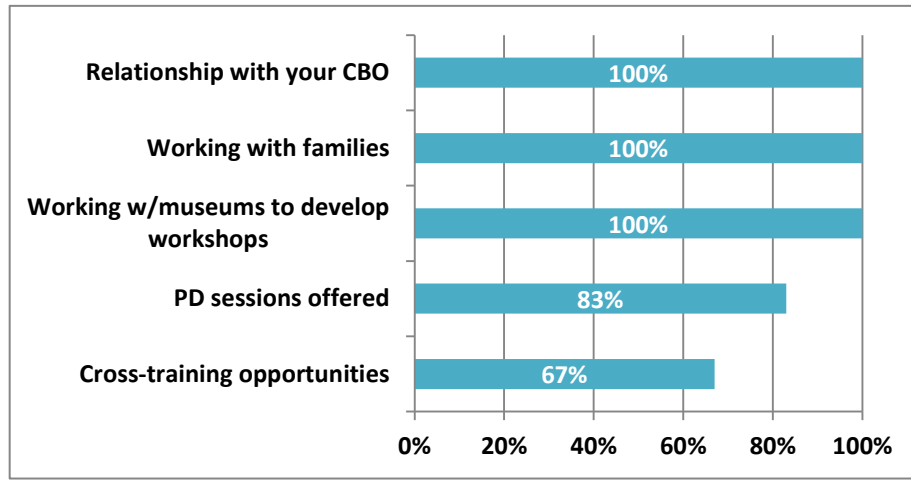
Apprentices

Satisfaction with Different Aspects of CLUES

“CLUES is a gem. It’s very special, and I think it should be recognized. It puts people in a different world. It’s almost like going to college; you learn so much. Or college and trade school combined. I really appreciate it for what it did for me. My wish is that so many more people could also participate in CLUES.”
–Former Apprentice

Apprentices were particularly satisfied with working with museum staff to develop museum workshops for families, working with families, and their relationships with their CBOs, as shown below. The majority were also satisfied with the PD sessions and cross-training opportunities.

Figure 24.
Apprentice Satisfaction with Components of CLUES in Y4



N=6

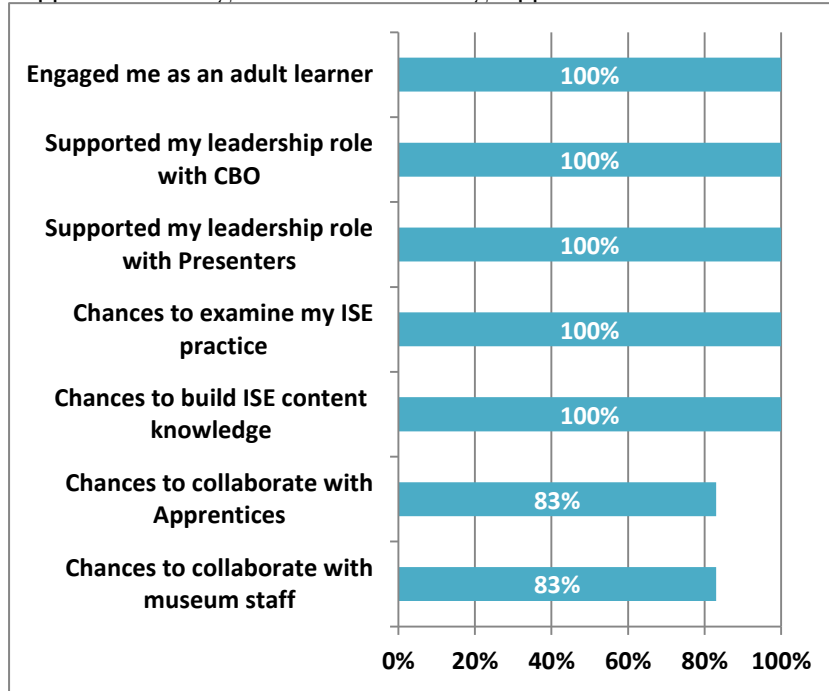
Note: Bars show percentages of Apprentices who were *very* or *extremely* satisfied.

Adequacy of Preparation and Skill Development

All of the Apprentices reported the CLUES program had *generally prepared me* or *prepared me very well* to develop and run programs and workshops, support museum staff at events and workshops, and train, coach, and mentor others.

All Apprentices *agreed* or *strongly agreed* that the CLUES program provided opportunities to learn about ISE content and to improve ISE practice as well as providing support for them in their various leadership roles and engaging them as adult learners, as shown below.

Figure 25.
Apprentice Ratings of CLUES Learning Opportunities in Y4



N=6

Note: Bars show percentages of Apprentices who were *very* or *extremely* satisfied.

General Assessments of the CLUES Program

Before beginning the CLUES program, Apprentices were asked to choose and rank their top five goals from the list shown below. In Y4, 83 to 100% of the Apprentices reported CLUES was successful at meeting their top three goals.

Table 26.
Y4 Apprentice Goals and Success of CLUES at Meeting Those Goals

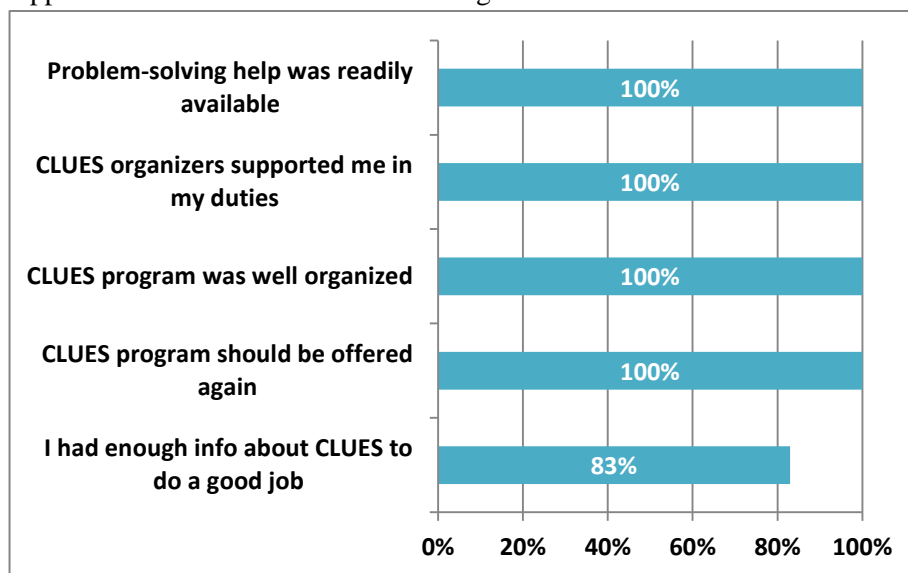
Goal Ranking at Baseline (1-14)	Goals	CLUES Very or Extremely Successful at Meeting Goal at Year-End
1	Learn skills or new tools.	100%
	Develop presentation/communication skills.	100%
	Develop leadership skills.	83%
2	Develop science-related skills.	100%
3	Provide mentoring to less experienced informal science educators.	83%
4	Help me get a better understanding of what ISE is.	100%
	Have fun.	100%
	Meet ISE professionals.	83%
	Make a positive change in my community.	83%
	Develop career-related skills.	67%

5	Make friends.	100%
	Build my resume.	100%
	Earn extra money.	100%
	Develop teamwork skills.	67%

N=6

As in prior years, Apprentices had very positive assessments of the support they received to solve problems and fulfill their duties and of the value of the program, as shown below.

Figure 27.
Apprentice Assessments of CLUES Program in Y4



N=6

Note: Bars show percentages of Apprentices who *agreed* or *strongly agreed* with the statement.

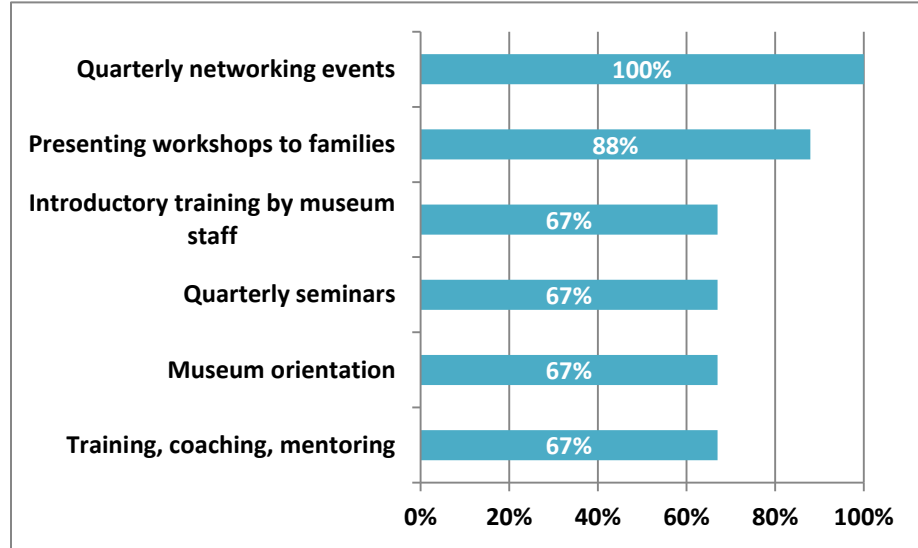
Presenters

Satisfaction with Different Aspects of CLUES

The majority of Presenters were satisfied with various aspects of the CLUES program, most particularly the quarterly Networking events and presenting workshops to families, as shown below.

Figure 28.

Presenter Satisfaction with Components of CLUES in Y4



N=8

Note: Bars show percentages of Presenters who were *very* or *extremely* satisfied.

When asked for the highlight of the CLUES program for them, six Presenters mentioned the chance to work with and teach children and families; responses included the following:

Just working with kids and seeing them happy and learning something new and exciting.

Definitely the families and watching them enjoy the workshop.

When kids actually understand and enjoy the workshop.

Teaching children and adults useful and relevant info. For example: best seafood to buy, how much sugar is in a soda.

Teaching workshops.

Two Presenters discussed their own learning, though one linked that to the satisfaction of sharing that learning with the families: *“Learning new things about science”* and *“Learning something new and passing it on to families.”*

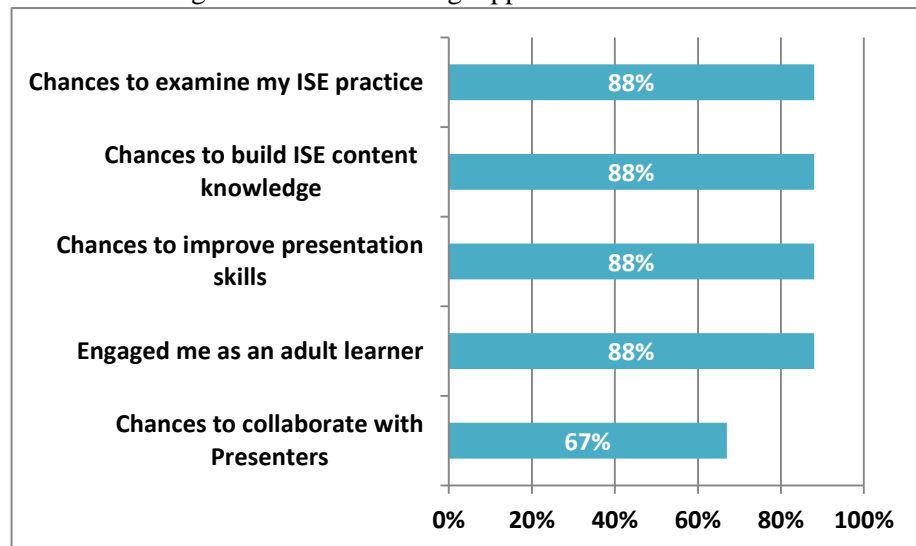
Challenges for Presenters included language issues: “Adapting the presentations for adults who don’t speak English well” and “Communicating with participants that don’t speak English.” Two mentioned behavior management: “When the kids don’t behave” and “Classroom management, especially when the families are very familiar with each other.” Two others listed workshop preparation: “Finding time to learn the workshops” and “Working and preparing workshops.” Finally, one mentioned “Speaking in front of people.”

Adequacy of Preparation and Skill Development

Eighty-eight percent of the surveyed Presenters reported that their CLUES training *generally prepared me or prepared me very well* to run local CBO programs and workshops. All Presenters *agreed or strongly agreed* that the training was sufficient for them to perform effectively (100%), and most *agreed or strongly agreed* that the CLUES training supported them to serve in their Presenter role (88%).

As shown in the figure below, most Presenters also agreed that the CLUES training engaged them as a learner in the approaches they would use with families and provided opportunities to improve presentation skills, build ISE content knowledge, and examine their own ISE practice. The majority also agreed they’d had opportunities to collaborate with other Presenters.

Figure 29.
Presenter Ratings of CLUES Learning Opportunities in Y4



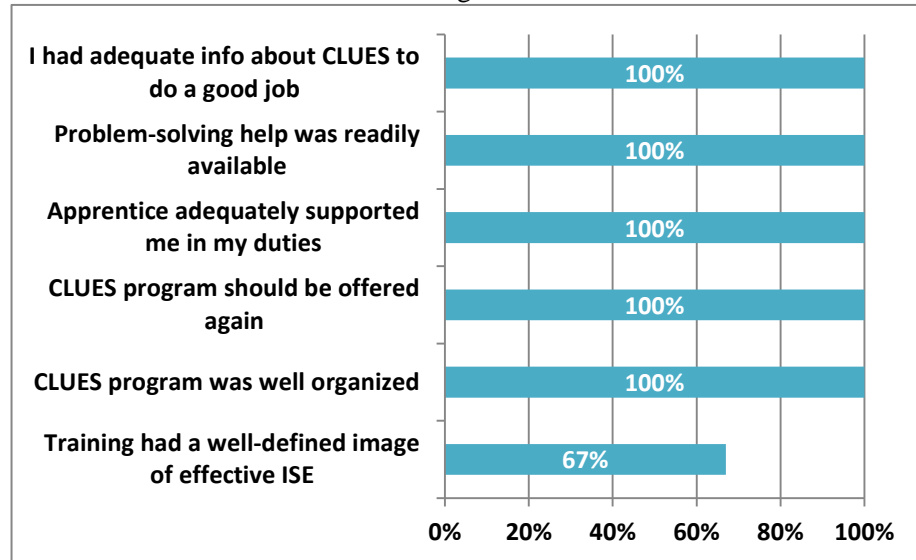
N=8

Note: Bars show percentages of Presenters who *agreed or strongly agreed* with the statement.

General Assessments of the CLUES Program

As shown below, Presenters had extremely positive general assessments of the CLUES program, particularly in terms of its being well organized, worthwhile, and supportive.

Figure 30.
Presenter Assessments of CLUES Program in Y4



N=8

Note: Bars show percentages of Presenters who *agreed* or *strongly agreed* with the statement.

Suggestions for Improvement

The Presenters had a few suggestions for improving the CLUES program. Two would like more training: “*Learning how to speak louder*” and “*More training on presenting.*” One mentioned providing more for families: “*More opportunities to bring families to museums as a workshop.*” Finally, a fourth suggested “*getting local business involved with the program and community.*”

Community-Based Organizations (CBOs)

Program Highlights and Benefits

“CLUES is a beautiful picture of getting messages to a community that otherwise wouldn’t have an opportunity, because we come to them. If they get so engaged at a workshop, they’ll want to go to a museum when the opportunity comes up because they’ll be curious. How strong that is!”

–CBO Partner

All of the CBO partners interviewed valued the opportunities CLUES offers families to learn and to visit places they might not otherwise have a chance to experience. Some representative comments include:

Our families and youth have been becoming stronger in the sciences and the environment and conservation and what it means to be involved in environmental justice. One person doing one little thing turns out to be a big thing if you’re consistent. They’re getting it; they’re connecting those dots....It’s all connected. It impacts you and your community and the city and globally.

The people that have been involved, it has impacted positively. They learned. They definitely said things like, “I didn’t know this before.” They liked the topics that were chosen for them.

A lot of my families are very, very low-income. CLUES has empowered them. Without CLUES, they would never have the opportunity to go to any of the museums. CLUES has even provided buses. It’s the opportunity of a lifetime. Because of that, I have very, very good turnout.

Another CBO partner shared a story of one little girl taking what she’d learned at a CLUES workshop and running with it:

Another high point that just happened is seeing families having a lightbulb moment. We just did a workshop on sugar in soda, and these little kids around 7 to 10 were talking about it among themselves afterwards. And they were going home and telling their mothers...This one little girl, she was so serious, so the opportunity to change a child. She said, “I’m going to take it to Sunday school!” She asked her mom, “Is that why grandma goes to dialysis? I don’t want you to end up like that!” So this knowledge seemed to be very profound for that little girl.

Another CBO partner also mentioned a particularly powerful workshop:

A highlight? Our last workshop for sure! What I’ve been looking for to come out of our workshops is they get excited and learn. Something that really says, “Damn! Right in your face!” Because that carries over into your home life.

Other CBO partners valued their Apprentice, their partnership with the CLUES program, and the value it has for Presenters:

“Working with all of the organizations that are in CLUES is a highlight. It’s information on top of information. You go to the meetings, and we’re all like partners. They say it takes a village to raise children. Well, it takes a whole bunch of organizations to make a child a great citizen in the community they come from. They aren’t born leaders; they become great leaders by what we put into them.”
–CBO Partner

My [CBO]’s Apprentice was really, really great. I was at every workshop. She was very positive. She came to a lot of extra nights that we have, family nights, and promoted CLUES very well.

Again, it’s the approach that you put into it. CLUES is to me so valuable in that it is a tool that allows me, when I go somewhere, to always talk about [my CBO] and CLUES together. Because we are partners.

For the Presenters, they get more working experience, experience speaking in public, knowing how to handle the children and families.

Finally, one longtime CBO partner praised how well the CLUES program worked in Y4:

The workshops were more focused; the topics were more relevant. In general, the museum and staff had better planning and conversations.

Program Challenges

As in prior years, a number of the CBO partners encountered challenges around family recruitment and attendance:

I guess it was the numbers, just getting families out. It was even harder this year. We usually have an after-school program, so there are kids there and their parents stay, but in October, the funding got cut. So the numbers were not as good as last year. Not that they were great last year, but they were lower this year. But [Apprentice] was great; she stayed positive and it didn’t deter her. She was really good [at promoting CLUES].

The hard part for me, it’s a hard time to recruit families; to attract more families. I tried different schedules, different things, but I have no idea what would work.

A downside? People promise to come to outside events and then half of them don’t come, even if you call them in advance. It’s not always the same people. So we do push the information to them; I’m not sure if there’s anything we can do about that.

Another perennial challenge is logistics, including time, resources, and scheduling:

Since [our CBO] is such a big multi-service organization, so many things are being done on different levels; we have a lack of time.

Being able to do more. We did three workshops, but we wanted to have the capacity to do more than that. We want to have the capacity to reach out to a wider audience; this year was not at the level we wanted. I'm not sure if there is anything our CBO can do about this, and by the time you get the hang of it, the funding has run out.

There was bad weather this year. There were workshops canceled because of the weather, and it was really hard to reschedule.

The most challenging thing was my Apprentice's schedule this year. Her schedule became really challenging. [Something happened] that wasn't on her plate when she first signed up.

Another CBO partner discussed workshop design issues:

Parents want the kids to do the hands-on activities, so the challenge is to engage the whole family. Because if you do, then the whole family will do the activities at home. Also, introducing opportunities that are not so far over their head that they can't do it, or when they go home, give them hands-on things that are easy for families to do at home, but that are not really costly.

Finally, one partner noted that in Y4 in particular, the Apprenticeship's shortened hours and lower stipend were a challenge to recruitment:

The time commitment [for Apprentices] is huge, 30 hours a week, with a small stipend. We lucked out to find [our Apprentice] this year. The model's intention was good, but without more money for wages and salary to attract the right people, it can be difficult.

Museum Partners

Program Highlights and Benefits

“It’s been great to have the CBOs represented by Apprentices and to build connections among community outreach programs. It’s a strong direction for the future; it transcends federal funding, and it may allow some efforts to continue with or without funding.”
–Museum Partner

As in prior years, museum partners were personally gratified to see the Apprentices’ growth and professional development; for example:

Watching the growth of the Apprentices, through the workshops...Watching them gain confidence and gain their approach to teaching people in the community, making relevant connections with the audience, using fewer PowerPoints, and just listening to their excitement. For example, [Apprentice] would be bouncing with excitement after learning something.

To see [Apprentice] being able to create a workshop and be proud of it. Also, she was afraid of a lot of things in the museum, the animals. So for her to conquer that and request to be in this space, that was pretty cool. She made a lot of progress. It was quickly evident that the museum life was for her. There was the passion and the energetic feelings to her conversation.

I enjoyed working with the Apprentices and got to know them really well from the ground up. [Apprentice] had experience beforehand and knew what goes into developing a program for ISE. [Another Apprentice] started from scratch, and it was very rewarding watching [that Apprentice] blossom and start to accept challenges.

Several of the partners mentioned that this final cohort was special, attributing part of this to their applying lessons learned in prior years about Apprentice recruitment and selection:

We had a great crop of Apprentices. They’ve gotten progressively better. The first two years were a learning experience, and we learned. [Was it about selection?] To my way of thinking, that was primary. They had greater maturity.

The highlights for me were in the Apprentice program and the fact that I think they, as a group, did far better than previous groups.

The museum partners also applied lessons learned to the Apprentice PD. As noted above, much of the PD took place earlier in the Apprenticeship and focused on relevant content as well as on practical guidance and plentiful feedback on using best practices based on inquiry and discovery:

One of the biggest highlights was finding the balance between skill building and science knowledge content. This resulted from the tweaks that we made in our PD with the Apprentices, which enabled the Apprentices to successfully execute not only one or the other in their workshops, but both. In past years, the PD tended to lack in one department or the other, but this year we were able to figure out the proper mix of both.

[Another highlight] was the change in focus in the PD and how beautifully Susan and Linda handled that.

Serving the CLUES families was also personally rewarding for museum partners:

As someone constantly doing things on the ground, when the families come to the museum it is always a highlight...afterwards, they always come up and hug you at the end, or send thank you notes afterwards.

*“The benefits to us are that we fulfill our mission of creating accessible programs for audiences that the museum doesn’t reach for whatever reason.”
–Museum Partner*

The museum partners also spoke insightfully about the benefits to their museums of the CLUES program and of the PISEC partnership more generally, particularly in terms of connecting their institutions to the community in deeper ways:

The main benefit is that we have wonderful relationships with the other museums and community partners that come into play in many ways; for example, applying for grants together. We see one another as partners and not competitors. Community organizations will approach us as partners; for example, asking to host their prom pictures at our venue. We see ourselves as integral with the community.

You reach a different audience. The Franklin is more popular, but the Academy of Natural Sciences is a natural history museum. Urban people know about the Franklin. When they find out about the Academy, they love it, but they don’t already know about it.

There are mostly benefits [for us]. It’s great to get out into the community, and many people would not be able to afford these events. The biggest benefit is the opening of our doors for families to come in.

There are also specific advantages to having Apprentices doing floor work at the museums:

On the museum side, [with Apprentices], you get someone who enjoys what they do, and that creates a good experience for the visitors.

It's also been wonderful to have Apprentices as additional staff here at the Institute. Let's not discount that! And it's good for the staff here to meet other kinds of people, people who are older and people who are younger than the traditional staff we have. The traditional staff have to have a college degree. I don't think [CLUES] will change the hiring here, but I think it was a good experience for the staff.

Program Challenges

From the museum partners' point of view, one of the greatest challenges in Y4, as in prior years, was a lack of time and resources on their own part as well as among CBO partners and Apprentices:

The challenges are always the same. Trying to get everyone around the table to do planning or troubleshooting. But it's not unexpected, and it's not insurmountable.

I had the same challenges as the year before; my position changed, and I no longer had staff to help manage projects. It was a challenge to fit the responsibility of CLUES into my new role on my own.

Everybody has a role in [CLUES], but they have different circumstances, so sometimes they can fulfill everything and sometimes they can't. There's inconsistency, like people leave the CBOs, or somebody gets something dumped on them that they didn't have before.

Time! I go back over this and say, "Is this possible in one year?" The first year, we kept [the Apprentices] for two years, because it took at least six months to get up to speed. Also, keeping everybody involved the whole time. There are three parts the Apprentices need to do: There's PD, museum support, and CBO connections. If one of those isn't working, it doesn't work.

A few museum partners mentioned challenges having to do with their work with the Apprentices:

The biggest challenge was to reach all of the Apprentices as much as I could with this new way of teaching and learning, a questioning style instead of just talking and delivery from the presenter, plus getting them to make connections to their lives. Most were not used to this new way, sometimes it felt like an uphill battle to get them to recognize what I was doing.

The biggest challenge and disappointment was the two Apprentices who didn't work out. It can be hard finding Apprentices who are willing to take on the time commitment of the job, which [this year] was more than part-time yet less than full time. But out of the eight who started, six were awesome.

Managing the different kinds of personalities. I had an older one and a younger one. The younger one was immature, and the older one was set in her ways. The younger one could care less if things ran smoothly, and the program might not have been the best fit for [the older Apprentice]. Museum life wasn't the best fit for her.

Another museum partner mentioned the challenges of recruiting families to attend CLUES events:

Getting families to show up. We would love more of them to take advantage of it. We're communicating enough; we're doing a better job of that. So it's not anything we can change; it's just the day-to-day stuff where people get to the day and something else comes up and they don't go. We can't really effect change in that...It's not a matter of our communication vehicles; we're hitting those in every way, and even the ones that are specific to each community.

Finally, another museum partner noted a decrease in Y4 of her role supporting her Apprentices in developing their CBO workshops. Whereas in prior years, she had shared resources and given them feedback, but this year she only worked with her Apprentices around her museum's events and workshops.

THE FUTURE

“I think the organizations, we’re 22 or 23 years in now. Even if we don’t do [CLUES], most museums will still try to invite families to events and workshops continuously. It has become ingrained in us.”

–Museum Partner

THE LEGACY OF CLUES

The CLUES program and its predecessors (e.g., CASE, FEST, etc.) have had a lasting impact in terms of creating and sustaining strong partnerships. Several museum partners mentioned the enduring PISEC partnership, which is seeking a next phase of funding to develop CLEAR (Communities of Learning for Environmental Activities and Research). Comments include:

In addition to applying for funding to continue on here, the partnerships are so long-lived at this point that the life of it will continue. We can do events with CBOs at very little cost to families. We will continue to try to offer opportunities for families to continue to do science, beyond the lifetime of the grant.

We’ll continue to run [CLUES] programs in the summer and fall, and we’re seeking funding to extend some of the best bits of CLUES. We know the partners want to; we see the value to the community and also to the museum organizations.

I’d like to think that we’d still keep contact with some of [the CBOs]; for example, [partner and second partner]. [Third partner] is great, but she’s extremely busy. If we could offer things, she would be interested in staying involved.

However, one museum partner wondered if PISEC could continue in quite the same way without continued funding:

I’m unsure if [my museum] has the capacity to continue these relationships without the funding being there.

The CLUES program has also had a lasting impact on the Apprentices and CBO partners, as mentioned by one museum partner:

The Apprentices have been indelibly changed in a lot of different ways. A lot of the representatives from the CBOs have been changed too. [CBO partner] was really excited about the change she saw in families who were buzzing about a family workshop. She has a good idea now of what gets through to families. It’s not just about science content; it’s about living your life, what you can look for and make sense of on your own. They are continuously looking for science opportunities for families.

“We will always engage with the things that CLUES has introduced to us.”

–CBO Partner

Several CBO partners agreed:

I will definitely continue to share the workshops with families. If CLUES was to stop, the information would still get out there. I’m also at UPenn, and they give me tickets. And the 3rd Wednesday of the month is free at the Franklin. So there are opportunities at different times.

Yes, [CLUES will live on]. Not to the same level with this funding, but certain aspects will continue depending on the resources at the CBO level. [Our CBO] will continue workshops in the summer.

I think [CLUES will continue]. We try to provide as much science education as possible. The partnership has also provided a long-lasting relationships between CBOs and Apprentices, which opened the door for more communication and collaboration.

THE FUTURE OF SIMILAR PROGRAMS AT THE CLUES ORGANIZATIONS

All of the museums have other informal science education programs, including some focused around climate change, watersheds, and other environmental science topics. As long-time partners in PISEC, the museums are also quite committed to community outreach, particularly to underserved local neighborhoods:

It goes along with our mission statement: We want to be a vital part of the community. Our organization is very invested in the idea of being a useful part of the community. For example, we are currently working with [CBO] to apply for a grant; it’s unrelated to PISEC, but it’s important to the community.

We’ll continue with a variety of programs...It’s part of our mission and our culture to give back to the city. In terms of environmental stuff, we’ll continue to grow the activities and create access to science and to information about natural resources, either directly through kids or with families. It’s possible we’ll have a watershed education center attached to the aquarium that will be free for anyone to come through.

[We] already do stuff in the community. Every summer, we do free camps; we do stuff with [CBO] and other schools. [Another museum] has a number of other things...There’s [program], and they’re doing things to do with food and healthy eating. That’s their way of reaching the community. [A third museum] doesn’t do a lot on a family level, though they have an adult forum.

“I know this: [The museums] are keeping looking for stuff like this. They’ll come up with something else. They all know the benefits of CLUES. They understand what it can do. They’re committed.”
–Museum Partner

In terms of the CBOs, the future of similar programs looks very different depending upon factors including the CBO’s central mission, their commitment, and their level of funding, as noted by one museum partner:

It all depends on the CBO. I worked with [CBO], and because it’s a school, it’s always looking for things to offer their students, for science. So there’s potential there; it’s easy to pick up. Also [a second CBO], I worked with them a little bit. They have more money, and they can pay for workshops. I don’t know about the other CBOs. Some will try; some will try harder. Schools will try harder. But it all depends on finances; it’s not free anymore. But maybe they’ll get someone else to do it, like the Presenters or a former Apprentice. But that’ll probably cost them something.

In fact, however, representatives from two of the participating schools are unsure if this type of programming can continue without funding:

Unless CLEAR does get approved, I don’t see anything happening because we don’t have any funding. [Does the school do any other informal science programming?] No. Just CLUES. But families keep asking about CLEAR and whether that will happen.

If we don’t get CLEAR, maybe City Skies. But we don’t have the budget for that.

However, several of the CBOs have a strong commitment to continuing programming like this:

We will continue to promote it because we believe informal education is where parents can start to get involved in children’s’ education and build confidence. We believe the parent is the child’s original teacher, and this will continue to be our foundation. We will continue to seek support to accomplish this, and we will reach out and find out what we can get.

The mission of CLUES will definitely continue in the after-school program. Also, [our CBO] has collaborated with other organizations in providing resources if we can, and I have enjoyed meeting with other organizations that have the same passion for informal science education for the community.

Other CBO representatives described how they keep their eyes open and feelers out for other forms of informal science programming that they can share with their families

It’s building up; there are a lot of different things going on with the different organizations and institutions. There will be things from bird watching to digging tulips to looking at the stars.

It is hard to get [museum] tickets. But I tell people to look for the free days at the museum; look for an open house and put in on your calendar. You'll have things to go to every month. And open houses are a time for the museums to show off, so maybe they'll have food or entertainment, so it's not just a normal day. You can put together free things and quality things for your family to go to. The computer does it for you; just put in "free museum." Or go to the library and look at a calendar of events. I make people work for me; they get all this information and they tell me. I say, "If you can't afford the food, pack a lunch. Have a quality day with your family. And don't forget to take pictures!" You should pull out quality fun things to make your life feel centered.

A third CBO partner described a plethora of other informal science programming of which she is aware, along with various collaborations her CBO has with diverse types of organizations to offer family science programming, noting "Those kinds of things are continuing." She continued, "Out of working with CLUES, it has given us access into other science organizations, other organizations that are working on STEM projects."

TAKEAWAYS AND LESSONS LEARNED FOR OTHER ORGANIZATIONS

Partners at two of the museums explicitly compared the CLUES model to prior PISEC community outreach programs. Both noted the intensive focus on Apprentices involved a very large commitment from all involved. As one partner described it:

This model was particularly labor intensive, and while there were benefits for the Apprentices and for the families in that the consistency was good for families, it was labor-intensive. That connection [between Apprentices and CBO families] was really powerful. However, it took an enormous amount of time; two people's time. There's probably some sort of in-between between the full-blown CLUES model and the Ambassador model from CASE. There should be some kind of in-between that could be explored.

This partner also noted that the PD for Apprentices was extensive and a lot to ask of them. However, in CASE, while there was less PD, the Ambassadors were also less committed in terms of hours and pay, so there was more turnover, concluding, "So there must be an in-between, though I don't know what it is!"

Museum and CBO partners had a number of other tips for other organizations who would like to create similar programming. These include creating strong museum-community partnerships, fostering organizational commitment, and designing programming very thoughtfully. In terms of partnerships, one museum partner was eloquent:

We couldn't do it alone; the collaborative has been key, the museums and the CBOs. It's like Dr. Jolly was talking about 10 or 15 years ago in Dialogues on Diversity: You're not really truly going to have the representation you want unless you include the communities in every aspect, not just as front-line staff or the occasional exhibit on cultural things, but really integrating them at every point. The community organizations tell us what to do; we're not the be-all and end-all or the experts, no matter what anybody else tells you!

CBO partners agreed:

If you have a team — CLUES is working together as a team. If you have a group of people that is willing to commit, I think there could be CLUES everywhere, in every city.

Be open. Be flexible. When it comes to having museums as partners, I wouldn't trade them for the world. You're going learn something new, no matter how much you already know. Or you'll add on to what you know.

What we were good at, we had good partners in terms of the museum level who understand the need for the program. We nurtured those relationships. That network of community partners was built well and is important. Without having people willing to collaborate, this project would be difficult. CLUES built this in, how to create these various kinds of positive networks.

Regular and non-hierarchical communication is key to these partnerships, as noted by one of the museum partners:

The biggest thing to learn with a collaborative program like this is communication. Since we hold meetings often, every month, even if people only attend 80% of the time, that is still a lot of communication they are having. The ones who don't succeed in partnership are the ones who do not communicate. And it is essential that communication takes place as equals, not as "I'm going to tell you everything and you're going to listen," but as an open table of communication.

Another museum partner described the importance of organizational commitment to the program:

It's really important that the partners get on board and attend meetings. It helps to stay consistent, with minimal change in leadership and organizational structure. It's very necessary to get the buy-in of supervisors and the president and so on in order to make sure they are making time for this program.

One of the museum partners spelled out some of the other benefits of this kind of collaboration:

Everybody needs to do it. Not only engage with community organizations, but engage with each other as cultural organizations. There's a diversity of content there that's appealing and complementary. We're stronger because of it. It's not like other museums don't do it, but finding the time and the other resources to do it is challenging. Maybe bigger museums don't have to do it, but for smaller museums, they benefit enormously.

In terms of programming, both museum and CBO partners had tips. A museum partner noted:

Whatever population you are dealing with, you have to find out where they are, and instead of telling them what they should know or what's good for them, keep weighing back in to figure out what they are understanding...It's necessary to find out what's actually getting through.

Two CBO partners suggesting paying special attention to making workshops relevant and interesting for families:

Make sure it's relevant to your families. Keep your eye open so you can see the various changes and shifts with the children and families. See where you can build on it, build on it.

It's definitely worth it; these topics are beneficial for families to know. Focus on choosing relevant topics for families, cover them in detail, and take the time to educate families, but also, families should have discussions at home if the organization lacks time

Relevant programming should attract families, but CBO partners also had a few other suggestions to help with recruitment. One suggested enlisting families to recruit new families:

We have a philosophy of "Each one, teach one." So [families] are not just going [to CLUES events] for themselves. I tell them to pay for it with attitude. "Don't take it and hold it; take it and share it." So there are opportunities to make CLUES as big as it can possibly be. My parents are always looking for new parents to bring.

Another CBO highlighted the importance of collecting accurate contact information as families check into events in order to create a mailing list to use for recruitment. Another shared a successful method she used at her school:

The 8th graders have to do community service, and I had two groups of them go to all the elementary classes and do a mini-skit for CLUES. The teachers said the younger students were

really excited about it and wanted to come and learn about big cats!

She also suggested that a familiar, consistent program representative is helpful: *“It also helps to have an Apprentice whose face is recognizable, who comes out to things where families are.”* A museum partner agreed, and further noted that picking the right representative is key:

They should think very carefully about who they want to pick as Apprentices, because it can make all the difference in the success of the program. They should really commit it to paper and codify the qualities they’re looking for. In the beginning, we left it up to the CBOs, and they didn’t understand what the Apprentices would be doing. After that, we gave them more direction. [Did they also learn from that experience?] Yes; they lived it in the first two years!

Recruitment remains a continual challenge for programs like CLUES; as one museum partner noted,

It’s not always about money; it’s about picking and choosing among a lot of different things, and how do you get them to choose you. Be patient. For every two steps forwards, you may take one back.

Finally, one museum partner mentioned lobbying for workshop materials and lesson plans to be left with the CBOs, as they were in CASE, in order to enhance CBO capacity to deliver family science programming in the future. However, she is not sure if any concerted effort was made to deposit materials with CBOs.

SUMMARY AND CONCLUSIONS

IMPLEMENTATION OF CLUES PROGRAM

CLUES Events and Attendance

- In Y4 and Y5, there were 4,327 documented individual museum visits to nine large events and ten workshops. At CBOs, there were 851 individual visits to 63 community workshops.
- In total, 724 families made 1,198 visits to CLUES events in Y4 and Y5. The average family group included about two adults and two to three children.
- Over the five years of the CLUES program, there were a total of 17,720 documented visits to 24 large museum events, 34 museum workshops, and 327 CBO workshops.
- Most of the families (80%) who filled out FIFs in Y4 and Y5 had attended one CLUES event, while a fifth (20%) had attended two or more.

Families

- Most of the Y4 families (86%) belong to racial or ethnic groups historically underrepresented in STEM fields; that is, Black or African American and Hispanic or Latino/Latina. This has been strikingly consistent, with a similar racial/ethnic distribution in Y1.
- In Y4 and Y5, over four-fifths of the adults who attended CLUES events (82%) were women. However, adults brought approximately equal numbers of girls and boys to these events.
- Of the Y4 families, most (90%) speak English at home, over a quarter (27%) speak Spanish, and 4% speak another language.
- In Y4, at baseline, most families (81%) visited a zoo at least once per year, and the majority had visited aquariums (71%) and science museums (62%) with similar frequency. These percentages have grown since Y1 as the families participate in the CLUES program for multiple years.
- As in prior years, the top three reasons Y4 and Y5 families attended CLUES events were to do something as a family (69%), to learn about science (61%), and to have fun (52%).
- Y4 families ranged widely in participation in science-related activities at home at baseline; on average, about a third participated weekly or more often, whereas two-thirds did not. Thus, CLUES was effective at drawing families who were not necessarily already interested in science. In Y1, slightly more families were already interested in science.

- In Y4, on average, about half (52%) of families reported being knowledgeable about various urban environmental science topics at baseline, similar to the levels reported in Y1.
- Almost three-quarters of Y4 families (72%) also reported quite positive attitudes toward science at baseline.

Apprentices

- There were eight Apprentices in Y4, two at each of the four museums. However, two left the program early on, leaving six.
- Most of the Y4 Apprentices (83%) belong to racial or ethnic groups historically underrepresented in STEM fields; this has remained stable over Y1-Y4.
- Two-thirds of the Apprentices were women, as compared to half in Y1. Y4 Apprentices ranged in age from 24 to 67 years old. All were fluent in English; two were also fluent in a second language. Education ranged from high school to a master's degree.
- In Y4, all Apprentices worked at family events. Most were also involved in exhibit interactions (83%) and workshops (83%), and the majority participated in outreach (67%).
- Across Y1-Y4, there were increases in Apprentice participation in family events and exhibit interactions and decreases in outreach, day camp, animal handling, and school lessons.

Presenters

- Almost two-thirds of the Y4 Presenters (63%) belong to racial or ethnic groups historically underrepresented in STEM fields; this has remained relatively stable over Y1-Y4.
- All the Y4 Presenters were women; this has not historically been the case. Education ranged from current high school students to one Presenter with a master's degree.

SHORT-TERM OUTCOMES OF CLUES PROGRAM

Families

- In Y4 and in Y5, there were significant increases in the percentages of families who knew *quite a bit* or *a great deal* about CLUES-related environmental topics after participating in the program. Averaging across topics, the gain was 16% in Y4 and 8% in Y5.
- The Y4 knowledge gain was particularly dramatic for families who attended three or more CLUES events (average 28% gain in families) versus those who had attended fewer (average 4% gain in families).
- Family knowledge gains were dramatically higher in Y4 and Y5 than they were in Y1, when only frequent attenders showed significant knowledge gains, and then only for three topics as opposed to eight in Y4 and Y5.
- Compared to infrequent attenders, those who attended three or more CLUES events in Y4 were also significantly more likely to report awareness of environmental issues in their neighborhood at year-end (67% vs. 37%); there was no such difference at baseline.
- In Y4, parents in focus groups reported that the CLUES program had sparked their children's interest in science.
- The majority of Y4 and Y5 families found CLUES events *very* or *extremely* helpful in allowing them to explore environmental issues affecting their neighborhoods; this was true for museum events (77%), museum workshops (74%), and CBO workshops (70%). These assessments were similar to those in Y1.
- Almost three-quarters (74%) of families attending the Y4 CBO workshops used the associated take-home activities. On average, the activities were rated as somewhat above *very enjoyable* and *very helpful* in allowing families to continue science learning at home. Again, these assessments are similar to those made by families in Y1.
- In Y4, families reported significantly more interest in science in general (specifically, they were more likely to *disagree* with the statement that they did not have much interest in science); there was a similar marginally significant trend in Y5.
- However, there were no differences at baseline versus at year-end in the frequency of families visiting science institutions or engaging in science-related activities such as reading or watching programs about science.

Apprentices

- Y4 Apprentices improved their ISE-related skills after CLUES training, especially in the areas of developing and presenting CBO workshops. On average, they gained almost a full point on a 7-point scale from *beginner* to *expert*.
- Most Y4 Presenters agreed, rating their Apprentice as skilled at developing (100%), presenting (100%), and adjusting (88%) CBO workshops and at making a positive change in their communities (88%).
- All the Y4 Presenters *agreed* or *strongly agreed* that families found workshop participation worthwhile, and they rated the workshops as fun and engaging for both children and adults.
- Family ratings of Apprentice ISE skills in Y4 were somewhat lower, with skill ratings ranging from 53 to 61% of families across the different skills.
- CBO partners noted that Y4 Apprentices had shown growth over the year in terms of their presentation and interpersonal skills, their confidence, and their ability to connect with families and with their communities in a deeper way.
- Museum partners noted that Y4 Apprentices grew in their ability to develop workshops as well as in their presentation skills. They also noted gains for some Apprentices in their enthusiasm and interest in pursuing ISE work professionally.
- Y4 Apprentices made substantial knowledge gains in every area of urban environmental science assessed, with an average gain across topics of 1.5 on a 5-point scale. These gains were especially large in the areas of water pollution and treatment; neighborhood animals and habitats; how to reduce, reuse, and recycle; and climate change.
- Y4 Apprentices also reported substantive gains in their skills at training and mentoring Presenters, with an average gain across skills of almost a full point on a 7-point scale. Gains were especially notable for teaching hands-on skills, ensuring Presenter satisfaction, and adjusting Presented training when things were not going as planned.
- Most (88%) of the Y4 Presenters agreed that their Apprentices were skilled in all six of these areas.
- All or most of the Y4 Apprentices *agreed* or *strongly agreed* that participating in CLUES increased their understanding of ISE and their confidence in their ability to succeed in ISE and led to a fuller exploration of their career goals.
- After participating in CLUES in Y4, two Apprentices said they *definitely will* and two more *probably will* continue in the ISE field through school or a job in the next year; the remaining two were undecided.

Presenters

- In Y4, the majority of Presenters reported substantial gains in their knowledge of urban environmental science topics as a result of CLUES, especially the topics most relevant to the workshops: neighborhood animals and habitats, water pollution/treatment, inner-city health issues, and how to reduce, reuse, and recycle.
- All the Y4 Presenters *strongly agreed* that their CLUES participation increased their understanding of ISE and improved their presentation skills. The majority also *agreed* or *strongly agreed* that CLUES increased their confidence in their ability to succeed in ISE and led to a fuller exploration of their career goals.
- The majority of Y4 Presenters reported that they are now *a little more* or *a lot more* interested in science, in teaching others about science, and in a career in science.
- CBO partners noted growth in the Presenters over the course of their participation in the CLUES program in terms of their presentation, communication, and leadership skills.
- After participating in CLUES in Y4, three Presenters said they *definitely will* and three said they *probably will* continue in the ISE field through school or a job in the next year; two were *undecided*.
- At the end of Y4, three Presenters said they *definitely would* and two said they *probably would* move on to Apprentice training if it were available; two were *undecided* and one would *probably not* move on to such training.

STAKEHOLDER ASSESSMENTS OF THE CLUES PROGRAM

Families

- Families enjoyed CLUES events very much, with about three-quarters (74%) rating the CBO workshops as *very* or *extremely* enjoyable; the corresponding percentages were even higher for museum workshops (80%) and large museum events (84%).

Apprentices

- All the Y4 Apprentices were *very* or *extremely* satisfied with working with museum staff to develop family workshops, working with families, and their relationships with their CBOs. The majority were also satisfied with the PD sessions and cross-training opportunities.
- All the Apprentices reported the CLUES program had prepared them *generally* or *very well* to develop and run programs and workshops, support museum staff at events and workshops, and train, coach, and mentor others.
- All Apprentices *agreed* or *strongly agreed* that the CLUES program provided chances to learn about ISE content and improve ISE practice as well as providing support for them in their leadership roles and engaging them as adult learners.
- Most or all of the Y4 Apprentices reported CLUES was *very* or *extremely* successful at meeting their top goals of learning skills or new tools; developing presentation/communication, leadership, and science-related skills; and providing mentoring to less experienced informal science educators.
- As in prior years, the Apprentices had very positive assessments of the support they received to solve problems and fulfill their duties and of the value of the CLUES program.

Presenters

- The majority of Presenters were satisfied with various aspects of the CLUES program, particularly the quarterly Networking events and presenting workshops to families.
- When asked for the highlight of the CLUES program for them, six of the eight responding Presenters mentioned the chance to work with and teach children and families.
- Challenges for Presenters included family language issues and behavior management. A few others mentioned public speaking and time to prepare.
- Most of the Y4 Presenters reported the CLUES program had prepared them *generally* or *very well* to run local CBO programs and workshops. All Presenters *agreed* or *strongly*

agreed that the training was sufficient for them to perform effectively, and most *agreed* or *strongly agreed* that the CLUES training supported them to serve as a Presenter.

- Most Y4 Presenters also agreed that CLUES training engaged them as a learner in the approaches they would use with families and provided opportunities to improve presentation skills, build ISE content knowledge, and examine their own ISE practice. The majority also agreed they'd had opportunities to collaborate with other Presenters.
- Y4 Presenters had extremely positive general assessments of the CLUES program, particularly in terms of its being well organized, worthwhile, and supportive.

Community-Based Organizations (CBOs)

- All the Y4 CBO partners interviewed valued the opportunities CLUES offers families to learn and to visit places they might not otherwise have a chance to experience.
- Other CBO partners in Y4 valued their Apprentice, their partnership with the CLUES program, and the value the program has for Presenters.
- As in prior years, a number of the CBO partners encountered challenges around family recruitment and attendance; another perennial challenge is logistics, including time, resources, and scheduling.

Museum Partners

- As in prior years, museum partners were gratified in Y4 to see the Apprentices' growth and professional development. Museum partners were also pleased with the Y4 PD, which was front-loaded and focused more on both relevant content and inquiry-based best practices. Serving the CLUES families was also personally rewarding for museum partners.
- Museum partners also spoke insightfully about the benefits to their museums of the CLUES program and of the PISEC partnership more generally, particularly in connecting their institutions to the community in deeper ways. There were also advantages to having Apprentices doing floor work.
- From the museum partners' point of view, one of the greatest challenges in Y4, as in prior years, was a lack of time and resources on their own part as well as among CBO partners and Apprentices. Another museum partner mentioned the challenges of recruiting families to attend CLUES events.

THE FUTURE

- The CLUES program and its predecessors (e.g., CASE, FEST, etc.) have had a lasting impact in terms of creating and sustaining strong partnerships among museums and CBOs. The CLUES program has also had a lasting impact on the museums and CBO partners as well as on the Apprentices who were trained.
- All the museums have other informal science education programs, including some focused around environmental science topics. As long-time partners in PISEC, the museums are also quite committed to community outreach, particularly to underserved local neighborhoods.
- For the CBOs, the future of similar programs looks very different depending upon factors such as the CBO's central mission, their commitment, and their level of funding. Several CBOs, however, do have a strong commitment to, and plans for, continuing similar programming.
- The museum and CBO partners also shared a number of takeaways and lessons learned for other organizations to create similar programming, including:
 - Creating strong and non-hierarchical museum-community partnerships and fostering organizational commitment. They noted that communication is key to creating and sustaining mutually beneficial and complementary partnerships.
 - Designing family programming very thoughtfully. Museum and CBO partners emphasized the importance of meeting families where they are and ensuring that content is relevant and useful.
 - To enhance recruitment, CBOs mentioned enlisting participating families as recruiters, creating comprehensive contact lists, and having a familiar face representing the program to families.
 - Finally, one museum partner mentioned that to enhance CBO capacity to deliver family science programming in the future, workshop materials and lesson plans should be left with the CBOs, as they were in CASE.

LIST OF APPENDICES

APPENDIX A: ANNOTATED Y4 FAMILY BASELINE SURVEY

APPENDIX B: ANNOTATED Y4 FAMILY YEAR-END SURVEY

APPENDIX C: ANNOTATED APPRENTICE BASELINE AND YEAR-END SURVEYS

APPENDIX D: ANNOTATED PRESENTER YEAR-END SURVEY

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