New York Hall of Science

Science Career Ladder Retrospective Impact Study

Final Report

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EXECUTIVE SUMMARY

For more than 20 years, the Science Career Ladder Program at the New York Hall of Science has provided unique opportunities for middle school, high school, and college students to be trained and mentored as Explainers at the museum. The program is designed to encourage and support personal and professional development of these students, increasing their academic achievement, personal growth, and participation in science and teaching careers.

Previous evaluations have documented the impact on participants and opportunities for program growth. This report documents the findings and conclusions from Part I of a two-part evaluation project, conducted by the Institute for Learning Innovation (ILI), to update understanding of program impact. Part I builds upon and extends a previous retrospective impact evaluation conducted by ILI in 2002. The purpose of this retrospective study was to obtain up-to-date evidence of the Science Career Ladder Program's long-term impact in supporting and encouraging its participants' personal, professional, and academic development.

A sequential mixed methods design was used, beginning with a quantitative web survey of alumni (n=164), followed by a qualitative, semi-structured telephone interview with a sub-sample of respondents (n=16). The web survey response rate was approximately 27%, despite efforts to reach as many program alumni as possible. While many factors contributed to this somewhat low response rate, it could indicate a bias in the sample. Thus, it is advised to consider results conservatively, as a maximum level of impact.

Overall, the results of this study indicate that the Science Career Ladder Program has been continually successful at achieving its goals in impacting each of the targeted areas of participants' personal, academic, and professional growth. The study demonstrates that program alumni continue to draw upon the experience gained, the lessons learned, and the skills developed during their time working as Explainers at the New York Hall of Science.

Academic Achievement

Nearly all former program participants go on to attain advanced education (undergraduate degree or higher) at a far higher rate than the general population of New York City, with a particularly stark contrast among those identified as Spanish/Hispanic/Latino, where program alumni attain advanced education at a rate five times higher than those in the general population. However, many participants entered with already well-defined educational goals. Because these students were already committed to advanced degrees, the program caused relatively little change.

There was evidence to indicate that a smaller sub-set of participants had less well-defined goals upon entering the program, and for some individuals, the role models of fellow Explainers did encourage further academic pursuits.

The strongest impact on academic achievement was developing knowledge, skills, and confidence that they have successfully applied to academic settings, including: science content knowledge, study skills, learning habits of mind, confidence in oral presentations, and problem-solving skills.

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Career/Professional Development

There was a greater impact of the program on influencing career directions than there was on level of academic achievement, with more alumni reporting it influenced their decisions in some way. Program alumni largely choose careers and college majors in the sciences and in education/teaching. A large number of participants entered with a strong interest in pursuing one of these paths, although for some, the program helps reveal new directions.

The impact of the program seemed to be less in directing individuals to a particular career, and more as a test-ground for their choices. They could gain assuredness in their career choices through experiences that highlighted existing and new interests, passions, aptitudes, and potential. Many emerged from the program more confident in their chosen path.

Skills and Abilities

Development of various skills and abilities seems to be one of the strongest program impacts, and evidence shows these are skills that alumni continue to use throughout their lives and careers.

The main areas of skills that are developed include: communication abilities and techniques, self-confidence overall and in specific situations, problem-solving skills, interpersonal skills, and leadership abilities

Science Literacy and Engagement

The program positively impacted the lifelong learning habits of participants, fostering a desire to continue to explore science topics, as well as general curiosity about the world. Many participants acquired an increased awareness of the role of science in all facets of life and increased level of noticing and drawing connections between their lives and science topics.

The program also developed lasting positive attitudes about science, most notably among those participants who disliked or were intimidated by science upon entering the program. The result of participation was a changed view of science and its relevance in their lives.

Program Design

Motivations for entering and for continuing in the program were somewhat different and show a change in motivation that takes place over the course of involvement. Further, a majority of participants leave the program either for a job/career elsewhere or to attend school, both of which are in line with the program's objectives. Other reasons for leaving indicate there are differences in the challenges that are faced by participants during different phases of involvement in the program.

The program design builds participants' confidence in their abilities, particularly through training, peer-to-peer teaching, and relatable supervisors. Due to this, participants describe the program as supportive and encouraging, with co-workers and supervisors all forming a strong social network. The evidence also suggests the program supports the growth of individuals specifically in those areas where they personally need greatest development.

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Project Background

The Science Career Ladder (SCL) Program at the New York Hall of Science (NYHOS) is designed to encourage and support personal and professional development of students, often from underserved populations, increasing participation in science and teaching careers. For more than 20 years, this program has provided unique opportunities for middle school, high school, and college students to be trained and mentored as Explainers at NYHOS. Three major evaluations of the SCL Program have been previously completed, documenting impact on participants and opportunities for program growth. These evaluations included a retrospective impact study conducted by the Institute for Learning Innovation (ILI), which demonstrated important positive impacts that these leadership and employment opportunities have had on participants, including development of critical thinking and communication skills, improvement in self-confidence and attitudes towards science and teaching, and preparedness for future jobs or courses of study (Storksdieck, Haley-Goldman, & Cohen Jones, 2002).

This project represents a two-part evaluation of the NYHOS' SCL Program focused on measuring the short-term and long-term impact on program participants. Part I of this project, reported here, builds upon and extends the findings from the retrospective evaluation conducted in 2002. Through this new retrospective study, ILI measured the long-term impact of participation in the SCL Program, obtaining evidence of how the program continues to achieve its goals within the framework of the program's current impact priorities. Part II of this project evaluates short-term impacts with current program participants and is addressed in a second report.

Evaluation Questions

This project sought to answer an overarching evaluation question focused on five impact areas prioritized by the SCL Leadership:

> What is the long-term impact of participating in the Science Career Ladder program in supporting and encouraging personal, professional, and academic development?
> - Academic Achievement
> - Career/Professional Development
> - Skills Attitudes, and Behaviors
> - Science Literacy and Engagement
> - Program Design

Specific evaluation questions were developed to address each impact area.

Academic Achievement

In what ways do SCL alumni show growth in academic skills, abilities, and performance?

- Level of achievement in formal schooling
- Contribution of the program to their academic choices and decisions related to formal schooling
- Contribution of the program to developing skills useful in academic settings

Career/Professional Development

In what ways does participation related to or influence career choices of SCL alumni?

- College majors completed; specifically in the sciences or education
- Changes in majors/direction during college; specifically into the sciences or education
- Current careers; proportion in sciences, teaching, and informal learning
- Influence of the program on career decisions and changes in career goals
- Interest in science and teaching careers

Skills, Abilities, and Behaviors

What life and job skills, abilities, and behaviors develop and continue among SCL alumni?

- Communication skills
- Self-confidence
- Professional skills and competencies
- Other skills, abilities, and behaviors

Science Literacy and Engagement

How has the program fostered development of science literate and confident citizens?

- Positive attitude toward science
- Perception of science as a relevant part of everyday life
- Empowerment to participate in societal conversations about science
- Continued engagement in free-choice and lifelong learning about science

Program Design

How do aspects of the program's design contribute to success or limitations from the Explainers' perspectives?

- Aspects of the program that originally motivated Explainers[1] to apply
- Aspects of the program that motivate them to continue
- Leading factors that led them to leave the program
- Aspects of the program that helped build or lower confidence
- Influence of the social dynamic among Explainers and SCL staff

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[1] While the program's official name is the Science Career Ladder, its staff are called Explainers. Consequently, the program is often frequently referred to as the Explainer Program, particularly by its participants. This term was used consistently in survey and interview instruments for ease of understanding by participants. In this report, the term Science Career Ladder is primarily used, however any use of the term Explainer Program is synonymous.

METHODS

The impact areas selected for this study were defined and prioritized in discussions between SCL Program staff and ILI. Based on these priorities, ILI created an evaluation plan, using a sequential mixed methods design aligned with the methods used in the 2002 study. The study began with a quantitative phase, using a web-based questionnaire to survey SCL alumni in the program's contact database. Following review of these data, qualitative follow-up telephone interviews were undertaken with a sub-set of survey respondents in order to obtain detailed, information on specific impacts attributed to the program.

Survey

Based on the evaluation priorities set with the SCL Program staff, ILI developed a structured questionnaire to be administered to alumni as a web-based survey. The questionnaire consisted of primarily closed-ended and scale questions, with some open-ended questions to gather feedback in the participants' own words. Additional demographic information about the participants, their roles within the SCL, and their length of participation were collected for comparative analysis and trend identification. (See Appendix A for survey questions.)

The 2002 retrospective study was administered using a mail-back paper survey. The present study, however, used a web-based questionnaire. In addition, it used a three-pronged recruitment strategy in an effort to increase the response rate and reach of the survey. Invitations were sent via:
- E-mail
- Mailed postcard, including a URL to the survey
- Notices on social networking sites by SCL Program staff

The SCL Program's alumni database contained contact information for approximately 600 alumni with a mailing and/or e-mail addresses. To encourage participation by as many alumni as possible, an incentive was provided; every individual who completed the survey was eligible to be entered in a drawing to win one of four $50 gift certificates to Amazon.com. The initial invitation e-mail, social networking postings, and postcard mailings were sent to all alumni in the database on February 7, 2009. (See Appendix B for invitation text from postcard and e-mail.) A reminder e-mail was sent on February 20, 2009. Responses continued to be collected until March 15, 2009. Incentive prizes were awarded in mid-March, 2009. Ultimately 164 alumni responded to the survey, which represents a minimum response rate of approximately 27% before factoring in undeliverable postal or email addresses.

Data from closed-ended questions were quantitatively analyzed for common or prevalent responses. Those frequencies and distributions are presented and discussed in detail in this report. For some questions, sub-groups of participants based on relevant characteristics were compared to identify trends or differences in reported impact. Data from open-ended questions were coded by ILI researchers for themes and commonalities in the responses.

Follow-up Telephone Interviews

Since the survey questionnaire provided primarily quantitative data on the impact of the SCL Program, ILI conducted follow-up semi-structured telephone interviews with a subset of survey respondents. From a pool of 121 respondents who agreed to be contacted for a follow-up telephone interview, a sub-sample of 16 alumni participated in interviews with ILI researchers. A stratified sampling technique was used to ensure representation from alumni from a range of ages, career paths, and schooling experiences reported in the quantitative survey

The interview guide was developed based on initial analysis of the survey data. Each interview was customized to address specific areas of impact and answers provided by the respondent on his/her survey. The interviews were designed to obtain more detailed insight into the link between program participation and long-term impact. As a semi-structured interview, researchers were able to probe freely into participants' responses to better understand their reasoning and its connection to the evaluation questions. (See interview guide in Appendix C.) The qualitative data that resulted were assessed for trends and quotations were used to illustrate and explain results of the quantitative surveys. In many areas, these qualitative results provide additional richness and depth for understanding the true impact of the program on participants and areas of impact that were unexpected and not covered in the survey instrument.

Sample Bias

A return rate of around 27% suggests the potential that the survey results have a sample bias toward those alumni who hold more favorable opinions about both NYHOS and the SCL Program, since these individuals may have been more diligent maintaining contact with the SCL Program and more receptive to responding to a survey about that program. Although many attempts were made to reach out to alumni and encourage broad participation, we do not know the reasons why the other 73% of alumni contacted did not respond. Therefore, we suggest a conservative interpretation of the results presented here. The overall positive impacts reported by these participants may not be consistent with all participants. Minimal feedback was obtained from respondents when prompted to provide negative feedback about the program. While there is no evidence to indicate that the non-responding alumni had more negative or less positive impacts from the program, a conservative view would assume that the overall impact on all former participants may not be as strong as the results reported here indicate.

Also of note, due to the nature of the SCL Program, some of its alumni have become staff at NYHOS, progressing from the Science Career Ladder to become full- or part-time staff in Education or other departments at the museum. As program alumni who have progressed on the ladder, they clearly provide insight into the impact of the program; however it is also clear that they also have a greater connection to the NYHOS and the program than others. These responding staff participants were identified as a sub-set of the alumni (N=24, 15% of the overall sample). Due to their existing connection to NYHOS, it was presumed that they might have greater positive bias than other respondents. Significant differences between these current staff and other responding alumni are reported where applicable. Follow-up interviews targeted non-NYHOS employees to ensure the external perspective was captured.

RESULTS & DISCUSSION

Sample Description

In total, responses were obtained from 164 SCL alumni. Table 1 shows the demographic characteristics of this sample, of which nearly two-thirds were female (62%). The sample was generally young, with a majority of the respondents in their twenties. The racial/ethnic diversity of the sample seen in Table 1 reflects the diversity of program participants.

Table 1. Demographic profile of alumni respondents

	Percentage	Count
Sex (n=164)		
Female	62%	101
Male	38%	63
Age (n=162)		
Under 20	8%	13
20-25	37%	60
26-30	28%	45
31-35	13%	21
36-40	10%	17
Over 40	4%	6
Race/Ethnicity* (n=164)		
Spanish/Hispanic/Latino	35%	57
Asian	33%	54
White	26%	42
Black / African American	9%	15
American Indian or Alaska Native	1%	1
Other	5%	9

*Respondents could select more than one race/ethnicity. May add up to more than 100%.

These respondents were evenly split in terms of their grade level upon entering the program; 55% (90) were high school students when they started, whereas 45% were in college or graduate school (Table 2). A large majority of this sample entered the program at the Explainer level, whether as a high school student (38%) or college student (43%). Additionally, 12% joined at the Volunteer level and 7% joined at the Intern level.

The respondents also came from across all years of the program's existence, with the greatest number of respondents (34%) having started the program between 2001 and 2005, most of whom would not have been included in the 2002 retrospective study. The sample also included 31% who entered the program between 1996 and 2000, and one-quarter who joined the SCL prior to 1995 (Table 2). About 15% of the sample indicated they had siblings or relatives already in the SCL Program before they joined.

Table 2. Data about entry into the SCL Program

	Percentage	Count
Year Joined SCL (n=160)		
Before 1990	11%	18
1991 – 1995	14%	23
1996 – 2000	31%	49
2001 – 2005	34%	54
2006 – 2008	10%	16
Academic Status Upon Joining SCL (n=164)		
9th grade	10%	17
10th grade	17%	28
11th grade	16%	26
12th grade	12%	19
College Freshman	16%	27
College Sophomore	17%	28
College Junior	5%	9
College Senior	4%	7
Graduate School	2%	3

Respondents to the survey were more likely to be the people who had had the lengthiest involvement in the program. Nearly one-quarter of the sample (24%) had stayed within the program for four or more years, and 31% had remained for between two and four years. The greatest number of respondents (33%), however, fell into the mid-range of time involvement (between six months and 2 years). Another 10% of the sample had remained in the SCL Program for less than six months. Nearly the entire sample had worked at the Explainer rung on the ladder (90%), with nearly one-third (32%) reaching the Program Explainer level, and 16% reaching the Senior Explainer level.

In terms of current status, half of the respondents reported that they are working full-time, while 30% reported that they are undergraduates in college. Another 23% reported that they are working part-time, and 11% are currently enrolled in a graduate program (see Table 3). These results were consistent with the findings reported in the 2002 survey. Alumni were able to select more than one option to this question, revealing that one-quarter of respondents are working and going to school simultaneously.

Respondents were also asked to report on their parents' academic and professional experience to get a sense of the background of these alumni in terms of exposure to advanced education and careers in science, technology, and teaching. Results showed that the highest level of schooling completed by most respondents' parents was generally a Bachelor's degree or lower (see Table 4), with 18% of respondents' parents holding a high school diploma and another 11% of respondents' parents having only completed some high school. Further, the majority of respondents' parents (58%) did not have a parent who worked in any field of science, technology, engineering, mathematics, or teaching (Table 5).

Table 3. Where alumni are in school/careers currently (n=164)

	Percentage	Count
Working full-time	50%	82
College/University (as an undergraduate)	30%	49
Working part-time	23%	38
Graduate School	11%	18
Stay-at-home parent	4%	7
High School	4%	6
Community College	4%	6
Between jobs	2%	3
Military Service	1%	1
Other	1%	2

*Multiple responses allowed. May total more than 100%.

Table 4. Highest level of schooling completed by one or both of respondents' parents (n=164)

	Percentage	Count
Some High School	11%	18
High School Diploma	18%	30
Trade/Vocational School	9%	14
Associate's Degree	9%	15
Bachelor's Degree	24%	40
Master's Degree	17%	28
Doctoral Degree	3%	5
None of the above	9%	14
Total	100%	164

Table 5. Fields in which one or both of respondents' parents held jobs (n=164)

	Percentage	Count
Teaching	21%	34
Science	16%	27
Engineering	9%	15
Technology	8%	13
Math	7%	12
None of these	58%	95

*Multiple responses allowed. May total more than 100%.

Academic Achievement

Attainment of Higher Education

The first focus area explored the influence of the SCL Program on the academic achievement of alumni. Alumni reported their highest level of schooling completed to date. Of those who reported they are not currently in school, 84% of the sample has already attained a Bachelor's degree or higher; 40% holds a Bachelor's degree, 37% holds a Master's degree, and 5% holds a Doctoral degree. An additional 16% have completed high school, trade/vocational school, or an

Associate's degree program (Table 6). These numbers show that SCL alumni have achieved very high levels of formal education. In addition, of the 79 alumni who are currently in school, 34% (n=55) indicate that they have plans to pursue education beyond their current level.

Table 6. Highest level of schooling completed by responding alumni (n=164), as compared to 2007 Census Bureau estimates of NYC residents age 25-44.

	Percentage of SCL Alumni Respondents		U.S. Census Bureau Data
	Respondents Not in School (n=85)	Respondents 25 and Older (n=101)	NYC Residents Age 25-44
Less than HS Diploma	2%	2%	15%
High School Diploma	7%	7%	39%
Trade/Vocational School	2%	2%	n/a*
Associate's Degree	7%	12%	7%
Bachelor's Degree	40%	38%	25%
Master's Degree	37%	36%	14%
Doctoral Degree	5%	4%	n/a**

*Census data does not include category of Trade/Vocational School
**Census data reports only "graduate degree," without separating Master's and Doctoral levels.

To compare the educational attainment of alumni respondents to the general population, we used data and estimates from the U.S. Census Bureau[2], which report educational attainment by people 25 years of age and older. Using this criterion for comparison, we found that of alumni respondents who were at least 25 years old, 98% had at least a high school diploma, and 78% held at least a Bachelor's degree. For comparison, in 2007, just 32% of New York City residents age 25 or higher held a Bachelor's degree or higher. For an even more direct comparison to the SCL alumni sample, we examined the Census Bureau data to residents between the ages of 25 and 44 (the same age range as program alumni). Under these parameters, 39% of New York City residents held a Bachelor's degree or higher, substantially lower than the 78% of SCL alumni.

To further compare alumni to the general population of NYC, we explored educational attainment by race/ethnicity. Table 7 shows the percentages of program alumni and of NYC residents ages 25 and older who have completed at least a Bachelor's degree, broken down by the four racial/ethnic categories that were most represented among program alumni. These results show substantially greater academic achievement by program alumni in all of these groups, most notably in those who identify as Spanish, Hispanic, or Latino. While only 14% of this group have attained this level of education in the general population, 73% (n=27) of program alumni representing this ethnicity have received a Bachelor's degree or higher. Percentages in this table should be considered cautiously, as sub-groups by ethnicity have relatively small sample sizes (all are under 40 individuals). However, taken as a whole, all of these comparisons with census data show that the educational attainment of SCL alumni is substantially higher than the general population.

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[2] http://factfinder.census.gov

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Table 7. SCL Alumni (n=101) who have completed at least a Bachelor's degree by race/ethnicity, compared to 2007 U.S. Census Bureau estimates for the NYC general population.

	Completed Bachelor's Degree or Higher		
	SCL Alumni respondents (25 and older)		Census Bureau estimates of NYC Residents (25 and older)
	count	percentage	percentage
All respondents	79	78%	32%
Spanish/Hispanic/Latino	27	73%	14%
Asian	25	86%	40%
White	20	83%	43%
Black / African American*	4	36%	20%

*The number of alumni respondents age 25 and older who identified as Black/African American was very small (n=11). Due to this small sample size, percentages should be interpreted with caution.

While it is clear that program participants ultimately attain high levels of education, the survey also assessed the starting ambitions of participants when they entered the program, investigating if SCL participants develop new goals to attain more advanced degrees than when they entered. The results show that participants enter the program with pre-existing goals of achieving advanced education, with 40% already expecting to attain a Bachelor's degree, 26% expecting to attain a Master's degree, and 14% expecting to obtain a Doctoral degree (Table 8). This profile is very similar to the profile of degrees completed by alumni no longer in school, as shown in Table 5, but with a greater number of participants indicating they entered the program with the goal of a doctoral level degree and fewer participants expecting to obtain a Master's degree.

Table 8. Highest level of schooling alumni expected to obtain upon entering the program (n=164)

	Percentage	Count
High School Diploma	6%	10
Associate's Degree	7%	11
Bachelor's Degree	40%	65
Master's Degree	26%	43
Doctoral Degree	14%	23
I wasn't sure	6%	10
None of the above	1%	2

Specifically addressing the issue of pursuing more advanced degree, respondents were asked to reflect on whether the program increased or decreased their interest in going further in their education. While just over half indicated that the program led to some level of increase in pursuing further education, 49% indicated that it caused no increase or decrease in their interest in pursuing more advanced education. This is likely because they came in with rather pronounced ambitions prior to the program. We further explored this by asking how greatly the SCL Program influenced their academic achievement and decisions. About one-third (34%) indicated that the program strongly influenced their academic decisions, and just less than one-third (31%) indicated it had somewhat of an influence on their decisions.

In an open-ended question, respondents further explained how the program did or did not influence these decisions (n=136). These responses were coded into categories of the nature of the program's influence, as reported by alumni. While 23% (n=31) of all respondents to this question indicated that their future plans remained essentially the same from their entry into the program to completion, the remainder of respondents described ways in which the program influenced their decisions. These responses fell into three general categories: shift in values about themselves and education, influence on their academic focus, and influence on skills and knowledge. The frequency of responses that fell into each of these categories is presented in Table 9.

Table 9. Coded responses for how program influenced alumni's academic decisions (n=136)

	Percentage	Count
Future Plans Remained the Same	23%	31
Program's Influence: Shift in Values (Self/Education)	22%	30
Program's Influence: Academic Focus		
Strengthened interest	24%	33
Strengthened interest in science		25
Strengthened interest in teaching/education		9
Strengthened interest in communication/working with people		3
Discovered interest	17%	23
Discovered interest in science		6
Discovered interest in teaching/education		11
Discovered interest in communication/working with people		9
Program's Influence: Skills and Knowledge		
Knowledge and skills grew	16%	22
Misc.		11

*Multiple responses allowed. May total more than 100%.

Influence on Academic Decisions: Shift in Values

Some alumni did not come into the program with a strong vision of their academic future. When asked to explain how the program influenced their academic decisions, 22% (n=30) of respondents to the open-ended question described ways in which the program shifted their values about education and motivated them to go further academically than they would have otherwise. Data from follow-up interviews with participants revealed a number of ways in which the program influenced participants' thoughts about academics, science, and learning.

Perception of Self as Science Learner

Some respondents indicated that they came to the NYHOS with a very negative perception of science, disliking or even fearing it, based on their experiences with the subject in school. Often these respondents indicated that their experiences at the NYHOS helped them see science as interesting and as something they could learn, understand, and teach to others. For these participants, the program had a positive impact on both how they value science in their lives and their self-perception as capable science learners.

"I hated science growing up, I thought it was just about textbooks, but interestingly enough I dropped high school science class on a Thursday and then on Saturday I got hired as an explainer… I had bad science teachers in high school, they didn't love it, and I really barely passed, and I am not stupid. They just really weren't passionate about it. It was definitely the museum [that made me like science]. I think it was the relaxed atmosphere, I had a lot of peers and we would speak to each other about what we were doing and teach it to each other."
(Female, 31-35, full-time classroom teacher)

"When I started out I wasn't into science. The early stages of my life I had boring teachers and it was a weak topic for me. If you had asked me how I felt about science then I would have said 'boring!' I would never say that again. It is so much fun to break down science into simple terms, it's the greatest gift."
(Female, 31-35, full-time information technology)

Exposure to Role Models and New Academic Opportunities

Some program participants were most strongly influenced by the program's ability to expose them to academic paths they might not have known about or considered previously. A big part of this impact seemed to come through interaction with other Explainers and Education staff who became role models and opened their eyes to new academic paths. Role models seemed particularly important for those students who entered the program from communities or families where advanced academic pursuit is uncommon. The opportunity to engage and work with others and in an environment that valued this achievement was reported to be a positive influence on many of these students' sense of self as an academic achiever.

"The Explainer department emphasizes academic discipline which helped in focusing. It was also encouraging to be someplace where everyone around you was in college, planning on going to college, and in some cases making plans for a Masters or Ph.D. This was not the type of environment I grew up in, so it was great to have that experience somewhere other than school itself."
(Female, 26-30, graduate student in public administration, works full-time in public and social services)

"Being an explainer help me to realize that I had options. Seeing so many people my age going for their B.A. or, even better, going for their Masters helped me to see that I could do this also. Where I grew up, most people were lucky if they were able to get their diploma, so I felt that getting any degree was good enough. But now I see that there's no reason to limit yourself in life."
(Male, 20-25, undergraduate student in math education, ten-year goal: teacher)

R[3]: There were groups that were getting along based on the things they were studying in school. … For me, I interacted with the guys who were in the Engineering school. It did influence me. Even when I was in college they were there still. And they would give me help. In selecting subjects I should take so there was a flow.
I: They kind of advised you?
R: Yes. Mentors! They were mentors.
(Female, 36-40, full-time engineer, stay-at-home parent)

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[3] R=respondent, I=interviewer

Recognizing Talents, Realizing Potential

Interaction among Explainer peers was also reported to be an important contributor to the sense-of-self as an academic achiever. Peers were reported to be supportive of one another, helping by acknowledging achievements and encouraging fellow Explainers to pursue their potential. One participant noted the support and encouragement of his co-workers in the SCL Program prompted him to further his education and to pursue a career that would make use of his natural talents and potential. He attributes this influence to a major shift in the course of his life.

> "It made me want to go back to school. I was originally going to settle down and get a job, but a lot of people, they were going on about how I should get back in school and that I have talent; I can write, I can draw, I can speak, and that they would kill to have that. So I went back in… if I didn't go though that at the time, I would not be able to see the talents that I do have. I would probably- I wouldn't even have given school a second thought. I'd be working and living pay check to pay check."
> (Male, 26-30, undergraduate student in art and art history, ten-year goal: work at MoMA)

Influence on Decisions: Academic Focus

While 23% of survey respondents stated that they felt their academic goals remained unchanged by the SCL Program, all other respondents did feel that the program had some influence on their plans, primarily in the focus of their education (40%, n=54) – either strengthening or changing that focus. Many Explainers arrived in the program with academic interests, often related to science and teaching. The impact of the program for these individuals was often to strengthen that interest. Nearly one-quarter or respondents to this open-ended question (24%) stated that the program strengthened their preexisting interest, reinforcing that they were on the academic and/or career path that was right for them. This included confirming their interest, deepening their interest, providing knowledge and skills needed within their chosen path.

Strengthened Interest in Science

> "My love of science prompted me to become an Explainer and that only strengthens that passion."
> (Female, 20-25, undergraduate student in medicine/health, ten-year goal: doctor or astronaut)

> "Being an Explainer reinforced how much I loved science. It made me more determined to be a doctor."
> (Female, 20-25, undergraduate student in humanities, ten-year goal: work at New Yorker)

> "I wouldn't say that it changed, but reinforced. I was sure that I would go into the sciences. Well, pretty much since junior high, my interest was stronger than any other subject."
> (Male, 20-25, undergraduate student in electrical engineering, ten-year goal: work for power company)

Strengthened Interest in Teaching

> "I always knew I enjoyed working with children. Working as an explainer and then in the library (SAC) I had opportunities to be in a 'teacher setting' and enjoyed it even more."
> (Female, 31-35, full-time classroom teacher)

> "Yeah, I would say so [that the program reinforced desire to become a teacher]. It was like a long internship. If I wasn't enjoying myself, I would have said it wasn't my calling. People interested in teaching should have an experience like that. It tests you, if you're going to be an effective teacher or not. Dealing with all age groups different subject matter. It was a test facility for me. Found out that I enjoyed teaching and wanted to continue."
> (Female, 26-30, stay-at-home parent)

Discovered New Interest

Experiences in the SCL Program were reported to have directly changed the academic focus for 17% of all respondents. The changes were generally attributed to the discovery of a new interest area not previously considered, primarily science, teaching, or working with people. The follow-up interviews suggested that some participants developed a new respect for teaching, even if they chose not to pursue it professionally.

Influence on Decisions: Acquired Skills and Knowledge

Sixteen percent of survey respondents described the academic influence of the SCL Program in terms of skills and knowledge gained. These impacts fell into two main categories: science knowledge and communication skills. Through the process of learning and then teaching scientific content via exhibit floor demonstrations, Explainers' comfort level with basic science was increased. This new knowledge and different approach to learning (i.e., hands-on, active learning) in some cases actually helped Explainers see classroom science as more interesting and enjoyable. They also indicated that the program also helped them academically, with specific value placed on increased understanding content, increased achievement on tests, and more confidence as an active class participant. Physics and chemistry were the subjects most frequently mentioned, but other subjects were mentioned as well.

Science Content

> "Yeah, when I was in high school, in AP Bio and Physics. It [the program] did help me with science, microscopes and microorganisms, when it came to physics, light, electro-magnetics."
> (Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

> "Definitely helped me with science courses. Knowing the star lab helped me with physics in college."
> (Female, 31-35, full-time classroom teacher)

> "When I was taking physics last year, I had a physical understanding [of the concept], from the exhibits at the science center. So I relate a problem to a picture."
> (Female, 20-25, undergraduate student in humanities, ten-year goal: work at New Yorker)

"Although working at the Hall did not influence my career choice; it did help with some of my studies- such as anatomy, chemistry, and the information on modern medicine. The information gained while working at the hall was very beneficial to my studies."
(Female, 20-25, undergraduate student in nursing, ten-year goal: work in a hospital)

Communication and Presentation Skills

Those who chose to pursue non-science fields often cited communication skills obtained through the SCL Program as attributes that influenced their academic pursuits. Their reports most frequently highlighted the value of learning public speaking skills, leadership skills, and the ability to communicate with a wide variety of audiences.

"With the experience of public presentations as an Explainer; I was able to learn how to organize my thoughts and write outlines for papers; and present my thoughts clearly for the classes I took. Currently; I am working on a second Master's Degree (MBA)."
(Male, 36-40, full-time in public and social services, graduate student in business administration, ten-year goal: president or VP of an institution)

"I am currently a student. I took an Oral Communication class and a Multi Media Business Presentation class. Helped me get the A's,"
(Male, 20-25, undergraduate student in information technology, works full-time in information technology, ten-year goal: business owner)

"After working there I had this class, ecology or geography, and we had to give a group presentation and that went really smoothly. And I saw a few people who were nervous, and I thought, 'They have to go to the Hall!'"
(Female, 31-35, full-time information technology)

Learning and Study Skills

Alumni interviews revealed that involvement in the SCL Program had other positive academic influences on these participants. They cited their development of learning and study skills, based both upon learning about the exhibits and learning how to create and conduct demonstrations for an audience. Most of these alumni attributed the program with helping them to develop academic skills including study habits and how to organize ideas, all of which directly translated into success in their academic careers.

"Yeah, helped me look at different problems and how to think about them. One example, I was having a hard time with math, and I kept looking at this one problem in a particular way, and then I thought, maybe I should look at it from the back. So I looked back to front and front to back, so just using a different approach."
(Male, 26-30, part-time retail and service industries)

"Definitely, learning to ask more questions and not being afraid to ask questions. Before I might have been hesitant, but now it's not a problem. They made sure there was always someone available to answer any questions you had."
(Female, 20-25, undergraduate student in political science/history, ten-year goal: lawyer)

"Even in physics class now, my roommates and I were doing our homework together and talking about how to get the answer, and I'll have created a memory device that doesn't work from them and I'll have to think about another way to help them think about, it. How do you teach someone?"
(Female, 20-25, undergraduate student in humanities, ten-year goal: work at *New Yorker*)

Lack of Influence

As indicated earlier, the survey results showed a substantial number of alumni who reported the program had little or no influence on their academic decisions or goals to pursue more advanced degrees. This was generally attributed to the fact that these participants had entered the program with well-developed, pre-existing plans and goals. These respondents seemed to indicate that the program had more impact on career goals (discussed more in the next section) or that both academic and career goals were established before they entered the program. One alumnus in particular indicated that he felt a disconnection between his college studies and what he encountered in the program.

"See, I finished my bachelor's in 3 years and my masters in 1 year, which is hard to do in the <college name> system. So, I was self-disciplined and goal-oriented to begin with. My major and minor were already selected when I started. I knew what I wanted to do already."
(Female, 26-30, stay-at-home parent)

"While the explainer program did not do much to influence my academic decisions; it did encourage [me] to focus on the way science is explained to the general public; and has strongly influenced my future career plans."
(Male, 20-25, graduate student in chemistry, ten-year goal: science policy)

"No, I mean, we always thought there was a big disconnect between working there and our college life. I was never able to correlate the two. …I just felt that experience was completely different from what I did in college."
(Male, over 40, full-time public and social services)

Career/Professional Development

The second focus of this study examined the career choices made by SCL alumni and the impact the program had on their choice of college majors and long-term career decisions. In particular, the study looked at those with careers in the sciences and teaching. This included the programs/majors alumni selected to pursue in college, the careers they have ultimately selected, changes in their decisions over time, and the influence of the SCL Program.

College Majors and Programs of Study

Of the alumni surveyed, 66% (n=109) reported completion of an Undergraduate, Associate's, or Vocational degree program; 26% (n=42) completed a Master's degree. These 109 individuals were also asked to indicate the subject areas of their degrees. The open-ended question allowed participants to name a specific subject. ILI then coded and grouped the responses according to

the academic disciplines that emerged in these data. The results in Table 10 show that the alumni in this survey tended to gravitate toward science and teaching in rather large numbers.

Table 10. Subject areas of alumni's completed undergraduate and graduate programs

	Undergrad., Associates, or Vocational Degree (n=109)		Masters Degree (n=42)	
	Percentage	Count	Percentage	Count
Teaching/Education	9%	10	50%	21
Science Education		2		12
Math Education		1		1
Other		7		8
Sciences	38%	41	17%	7
Medical/Health*		8		5
Engineering**		6		1
IT/Computers/Tech		5		1
Other		22		-
Business	7%	8	2%	1
Humanities	22%	24	10%	4
Social Sciences	22%	24	19%	8
Trade	1%	1	-	-
Other	1%	1	2%	1

*including biomedical engineering
**non-biomedical

The greatest number of alumni (38%, n=41) completed their undergraduate degrees in the sciences. This covered a wide range of subjects, particularly biology, but also included chemistry, physics, and earth sciences. Other areas of science specified and more related to career paths, included majors in medicine or health (8 individuals), engineering (6 individuals), and computers or technology (5 individuals). The next most common subjects for undergraduate degrees were in the humanities and social sciences (22% for each). Common majors in the humanities included English, history, and fine arts (among others); common majors in the social sciences included psychology, political science, and economics (among others).

Education and teaching degrees were relatively uncommon as undergraduate degrees (9%, n=10), likely due to the requirement for a Master's degree in education by many public school systems, and that it is more commonly offered as a graduate level program. The results from a review of participants reporting completion of a Master's degree revealed that fully half (n=21) received a degree in education or teaching, with a large number of these degrees specifically focused on science education (n=12).

Changing Majors

Alumni were also asked about any changes in their major that took place over the course of their undergraduate education, and follow-up interviews explored what influence involvement in the SCL Program might have had on changes in direction. Of the alumni surveyed who had a Bachelor's degree, 26% (n=28) were originally undecided, and 27% (n=29) switched majors during college. The academic areas that these alumni ultimately completed were evenly

distributed across disciplines. Eleven of these individuals changed their major to be in the sciences, and seven changed their major to be in education. It was more common to change major into either the humanities or social sciences, with 17 alumni each indicating that switch. In follow-up interviews, those alumni who were influenced to switch academic paths described the ways in which the SCL Program influenced those decisions.

Switching to Science

For some, the experience as an Explainer opened the door to a profession in the sciences by sparking an interest in particular technological fields or subject areas, and instilling confidence in the individual's ability to succeed in these areas. This respondent in particular indicated the profound influence that the SCL had on her career trajectory by involving her in science:

> "The Explainer program changed my life. I used to believe that I wasn't cut out for any science-related field; but the Explainer program opened my eyes to the wonders of science. By teaching me the science behind the exhibits and demonstrations I discovered a latent; but natural passion for science and teaching. During my year as an Explainer I became a Biological Anthropology major, and at the end of the year I climbed the Science Career Ladder to the position of Science Programs Assistant. Today, I am a science teacher and the youngest Science Department Chair our school has ever promoted. I owe it all to the New York Hall of Science."
> (Female, no age reported, science classroom teacher)

Switching to Education/Communication

For others, the SCL Program helped them realize a love for education and teaching, prompting some of these college students to change majors or pursue future degrees in the field of education. The experience Explainers have in learning and practicing the techniques of teaching individuals and groups is often described as an introduction to the rewards that come from being a teacher. For some individuals, they can then identify a natural career path to pursue that may not have been considered previously.

> "The explainer program introduced me to careers in education, science, and communication. I was provided with hands-on training and was able to explore my strengths in each area. After leaving the Explainer Program, my academic goals became more clear and I was able to narrow down my career options. Most of the work I engaged in after the Hall of Science was in education or communication. I was a counselor in a high school and then in a college. I completed a summer education program at the <museum>; and became certified as a K-5 teacher and middle school language arts teacher…. I completed a Masters in social work and am now employed full-time. In the fall of 2009 I intend to begin a program in statistics. Overall, the explainer program had a strong and long-lasting impact on my career goals."
> (Female, 20-25, full-time in public and social services)

> "Being in the Explainer Program influenced me a great deal in my career decisions. I began college as a Psychology major and within my first year switched to Education. I now hold my Masters Degree in Education and am still employed by the New York Hall of Science."
> (Female, 20-25, full-time educator in informal learning)

Switching to Social Science and Humanities

Although these data show that a number of alumni chose to pursue fields other than science, technology, or education, the follow-up interviews with these participants showed that the SCL also had an impact on their career selection and paths. For these former Explainers, the influence was most often described as building self-confidence, self-efficacy, and contributing to the belief that they can be successful in whatever endeavor they choose for themselves. This included people who chose to switch out of the sciences to pursue something more personally interesting to them, as well as those who gained the confidence and ability to communicate that helped them develop self-esteem, pride, and success in life.

> "I think it taught me that science will always be in my life in some way. It made me more confident to not go into science… I came into college thinking neuroscience, and if I hadn't been in the Program, I might not have had the confidence to switch to literature."
> (Female, 20-25, undergraduate student in humanities, ten-year goal: work at *New Yorker*)

> "Art History is both writing and speech intensive. I had these skills before I was an Explainer; but I began to appreciate them more after I left the NYHOS. I use what I'm good at now to succeed in life. Since most African Americans can frown on the fact that you talk like you're better than them or like a white person. We've all met (at one point in our lives) that one person who didn't act like the majority of their ethic race. I know I don't [act like the majority of my ethnic race] but I'm more proud of that now than I was 9 years ago… I always saw the work I did at the Hall of Science as a springboard into Art History."
> (Male, 26-30, undergraduate student in art and art history, ten-year goal: work at MoMA)

In one case in particular, an alumni indicated that her observations of her co-workers and peers with the SCL Program was the spark for developing an interest in group dynamics that evolved into a pursuit of sociology as a career:

> "Sometimes I would be more interested in how groups of people were interacting, how the networks grouped, seniors, PPAS, it was very interesting and very intricate. For me studying the way we interacted and bonded made it interesting… Last semester when I was applying to colleges, my intended major was anthropology. I liked it, but I noticed that I was more interested in urban anthro… tribes don't interest me! How does the social life from two girls in Mississippi work, that was engaging! Then I took intro to Soc[iology]. It was more tangible. Growing up I was always examining people, so it [ideas in Sociology Class] was not something new, but this group network has a name and a description!"
> (Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

This particular example illustrates how working in an environment where one is engaged with the public and interacting with a wide diversity of people (both visitors and co-workers) might influence an interest in pursuits that reflect upon various elements of human nature and society, ranging from the social sciences to the humanities. All of these examples highlight the strength of the SCL Program, which, despite its emphasis on science content and teaching skills, provides support for individuals to develop strengths, interests, and pursuits that are best suited to them. It

seems as though many individuals, through their involvement in the program, are able to develop a better understanding of the subject areas, types of jobs, and areas of interest that motivate them to pursue as a career.

Career Choices

The alumni who are currently employed (n=118) listed their current occupation in the survey and whether that occupation was in a STEM (science, technology, engineering, or mathematics) field, as a classroom teacher, or in an informal learning setting. When asked to classify the field in which they work, 54% indicated they work in a STEM field, 22% work as a classroom teacher, and 32% work in an informal learning setting (Table 11). Considering potential overlap in positive responses to these separate questions, overall 67% (n=79) of respondents reported they worked in either a STEM field and/or as a classroom teacher. These results confirmed that a large number of program alumni pursue these fields. Excluding the 15% of respondents who are currently staff at NYHOS reduces the percentage of people reporting working in informal settings and in a STEM field.

Table 11 Percentage of respondents reporting they hold careers in/as…

	Percentage Responding Yes	
	All Alumni (n=118)	Alumni Not Staff of NYHOS (n=95)
...a field of science, technology, engineering, or mathematics?	54%	33%
...a classroom teacher?	22%	19%
...an informal learning setting (like a museum, science center, zoo)?	32%	11%

The open-ended responses regarding specific occupations were coded and grouped according to common job areas, with a focus on education and on science careers. These responses were coded by the primary function of the occupation, as determined by the research team, such that each individual's occupation fell into only one category. In most cases, this was a straightforward process. For instance, a science teacher, while holding a career in both education and the sciences, would be coded as a primary function of teaching and education. In other cases, such as an accountant for a biotech firm, the occupation was coded for its primary function (business), rather than the subject area of the company.

As shown in Table 12, 65% (n=73) of employed alumni responding to the survey hold careers in either a field of education or STEM, which corresponds quite closely to the reported results in Table 9 and is also equal to the results found in the 2002 SCL alumni study. The greatest number of employed alumni (43%, n=49) indicated they work in education or teaching. Follow-up questions determined that 27 alumni (23% of all alumni with jobs) were currently classroom teachers. These teachers are primarily in K-12 classrooms (19 alumni), with three alumni teaching pre-school and four teaching in higher or adult education settings. Eleven of these teachers (9% of all alumni with jobs) are classroom science teachers.

Table 12. Categories of current occupation by primary job function (n=113)

	Percentage	Count
Teaching/Education	43%	49
Science Education		13
Math Education		1
Informal Education*		17
Other		18
Sciences	21%	24
Medical/Health (including biomedical engineering)		9
IT/Computers/Technology		9
Engineering (other fields, non biomedical)		4
Other		2
Business	13%	15
Social and Public Service Fields	9%	10
Arts and Humanities Fields	6%	7
Retail and Service Industries	4%	5
Trade	1%	1
Other.	2%	2

*includes 14 participants who currently work at NYHOS

Careers in the sciences were also quite common, with 21% of respondents' occupations falling into this category. This number is much lower than the 54% of respondents who indicated they work in a STEM field. This can be attributed to those whose primary job function fell into a non-science category (such as teaching), but who self-identified the STEM-related component of their field. The two of the most common areas for science and technology careers were the medical and health/sciences (n=9) and information technology and computers (n=9).

Other occupations held by alumni include fields of business, including marketing, PR, accounting (13%); social and public service, including social work, psychology, and government involvement (9%); the arts and humanities, including film and other art forms (6%); and retail and service industries, including restaurants and retail (4%). It should be noted that this included full- and part-time employment.

Those who reported that they are currently in school (n=79) were asked to report what they would like to be doing as a career in ten years. Those responses were coded using the same system as above, and revealed that alumni who are still in school are also interested in pursuing careers in the sciences and education (Table 13). Among these respondents, 20% seek careers in teaching or education, while 39% plan to pursue a science career, a total percentage (59%) which is nearly the same as the rate of employed alumni with careers in science and teaching reported above. Although among employed alumni, a greater number are in teaching careers, while a greater number of alumni in school are focusing on science careers.

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Table 13. Categories of planned careers of alumni who are currently in school (n=79)

	Percentage	Count
Teaching/Education	20%	16
Sciences	39%	31
Business	8%	6
Social and Public Service Fields	15%	12
Art and Humanity Fields	5%	4
Undecided	10%	8
Misc.	3%	2

Application of SCL Skills in Career

Those alumni who are currently employed were asked to rate how often their occupation requires them to use various skills that are a central focus of the SCL Program, including teaching, communication, and science. As shown in Table 14, respondents indicated high and frequent use of the skills that are most emphasized in the SCL Program in their careers. Communication was reported to be the most frequently used skill (84%). An effective ability to communicate ideas appears to be transferable and applicable to a wide variety of fields. Teaching skills, such as instructing, mentoring, or coaching someone, was another skill set reported to be used frequently or very frequently (71%).

Table 14. Frequency with which respondents use SCL skills in their occupations (n=118)

	Percentage Responding					Mean
	Very Frequently	Frequently	Occasionally	Rarely	Never	
Communication skills	84%	14%	1%	1%	1%	4.79
Teaching skills	57%	14%	17%	3%	9%	4.05
Scientific skills	39%	17%	22%	13%	10%	3.64
Involve science in regular work activities	37%	14%	17%	14%	18%	3.38

Science skills and science content were somewhat less frequently involved in the daily jobs of responding alumni, but still well-represented. Thirty-nine percent reported that they very frequently use scientific skills, such as data collection, analysis, or drawing data-based conclusions, and 17% indicated they frequently use these skills. More than one-third said that their jobs frequently involved daily work with science content.

As could be expected, there were some significant differences between the responses of those alumni who are current NYHOS employees and those who are not. While there were no difference in their frequency of using communication or scientific skills, current NYHOS employees reported significantly more frequent use of teaching skills (mean: 4.70) than non-employees (mean: 3.89) (p<.008). They also reported more frequent involvement of science content in work activities (mean: 4.70) than non-employees (3.06) (p<.000).

The follow-up interviews allowed researchers to explore how the experiences with the SCL have impacted or benefited some of these respondents' current careers. In some cases, the science content learned at NYHOS is incorporated into their jobs, while in other cases the skills of teaching and communication are often drawn into their work.

Field of Science, Technology, Engineering, or Mathematics

> R: I am fire inspector. I deal with different chemicals, hazardous materials, so having knowledge of science is very helpful. I also have to speak for groups of people. I teach kids about fire safety, so my experience at the Hall was invaluable.
> I: How often are you working with kids?
> R: Once a month, we go to schools and then certainly adults too, I try and incorporate education everyday in my job.
> (Male, over 40, full-time public and social services)

Classroom Teacher

> "I have to do this science unit; it's a part of the curriculum. But my experiences there influence the way I do it. And it's not good for me as a teacher to only be excited about science and not other topics, but you really see how it affects the kids. They love science. It's more hands on."
> (Female, 31-35, full-time classroom teacher)

> "As an explainer I learned how to gauge someone's understanding of a topic very quickly. This is very important as a teacher 'cause we sometimes forget that everyone doesn't have the same amount of knowledge that we do, but they don't always like to admit it. Working with teachers especially I have to be able to realize if the way I'm teaching is going above their level of understanding. Also I now have the confidence to talk in front of a large group of teachers and students. Most important of all after meeting people of all different types of backgrounds I now know how to communicate effectively with anyone I meet in life and that will play an important role no matter what I do in life."
> (Male, 20-25, undergraduate student in math education, ten-year goal: teacher)

Informal Learning Setting

> "I don't think I'll be wanting to work at another science museum. I respect it, but when it comes to what I am really passionate about; it is art history… Because of the Hall I do want to work at a museum. <university art museum>, it's an art museum, very different in terms of content, but in terms of secretarial/interaction/speaking, will be easier for me in that sense. … You present to them and explain what it is; what movement, the composition, color pallet.
> (Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or informal learning)

Program Influence on Career Decisions

A greater number of alumni reported that the SCL Program had an influence on their career decisions than reported an influence on their academic decisions. As reported above, 65% of respondents indicated the program strongly or somewhat influenced academic decisions. In contrast, 84% of alumni surveyed indicated the program strongly or somewhat influenced their

career decisions, with 44% reporting it strongly influenced them, and 40% reporting it somewhat influenced their decisions.

When asked to explain how the SCL Program influenced these decisions, the greatest reported influence of the program was in helping the participants develop knowledge and skills that fed into and prepared them to succeed in the career they chose (32%, n=38) (Table 15). The other strongest influences of the program were that it either helped them discover a previously unexplored career interest/direction (25%, n=30) or strengthened a pre-existing interest (21%, n=25). Teaching and education was most often mentioned (n=20) as the field that participants discovered a new interest in from SCL participation, while science was most often mentioned (n=14) as the field/profession where the program strengthened pre-existing interests and direction.

Table 15. Coded responses for how SCL Program influenced alumni's career decisions (n=118)

	Percentage	Count
Program's influence on Career Decisions: Shift in Values		
Shift in values (Self/Education)	5%	6
Program's Influence on Career Decisions		
Strengthened interest	21%	25
Strengthened interest in science		14
Strengthened interest in teaching/education		8
Strengthened interest in communication/working with people		7
Future plans remained the same	10%	12
Discovered interest	25%	30
Discovered interest in science		10
Discovered interest in teaching/education		20
Discovered interest in communication/working with people		10
Program's Influence on Skills and Knowledge		
Knowledge and skills grew	32%	38
Other	8%	10

*Multiple responses allowed. May total more than 100%.

In follow-up questions and interviews, alumni stressed a wide variety of skills and knowledge that they gained from their experience with the SCL Program that have contributed to their success in careers. These responses are discussed in depth in the following section of the report, but included communication skills, problem-solving, interpersonal skills, and self-confidence.

Strengthened Interests

A number of alumni entered the program with a strong idea of the career path or field that they wanted to pursue. In interviews, these individuals often stated that the program was not really an influence on their particular career path, but it did provide an opportunity to strengthen and deepen that interest, similar to the responses presented in the previous section on academic decisions.

"I know I always had in my mind that I would go into science. So it didn't, it didn't discourage me, but I can't really speak that it encouraged me to go further. When I started there I already had my mind made up to be a teacher."
(Male, over 40, full-time public and social services)

"My dad, he was engineer, and I would idolize him. That was already in my head, that I wanted to do that."
[later in the interview]
"I knew I was going to go into math and science regardless of the program. …I think meeting with other people influenced a bit. People from other backgrounds, people going to Engineering schools, they would give us [younger students] the forms and stuff to help. I wasn't 100% sure, and the others did help encourage or influence a bit. I knew when they were studying their books; I knew I could do that. I would understand the Physics book from college but not the English book."
(Female, 36-40, full-time engineer, stay-at-home parent)

Discovered Interests

The survey responses revealed that teaching was an area that some people discovered as a new interest while participating in the program. As described earlier, these program participants were often the individuals who changed their majors or fields of study to Education. Even those who ultimately decided that teaching was not the right choice for them, the process of being an Explainer encouraged them to consider it as a possibility.

"I did think about becoming teacher. Before the program I'd be like "hell no" but I considered it and then decided it wasn't for me. So in the end I thought, I won't hate doing it, whereas before I would have never have considered it."
(Female, 20-25, undergraduate student in health science, ten-year goal: nurse practitioner)

"There was a point where I thought about going into teaching. I'm looking into that again actually. I kind of miss the teaching."
(Female, 36-40, full-time engineer, stay-at-home parent)

Confidence in Decisions

Another interesting aspect emerged in several interviews. It appeared that the true impact of the program was not just funneling students into particular fields; but rather, providing the supportive environment that allowed students to explore their interests, develop an understanding of the career path that was right for them, and gain confidence to make and follow those decisions. Examples below highlight how SCL alumni describe the influence of the program in helping them grow the strength to make these decisions.

"My parents wanted me to go to medical school and become a doctor. Being an explainer helped me realize that I should obtain an education that supported what I wanted to; not what my parents wanted me to do."
(Female, 20-25, undergraduate student in health science, ten-year goal: nurse practitioner)

"When I got to college I enjoyed science, but I discovered another area that also interested me even more, and that was industrial engineering operations. And today I am doing finance related stuff. I think it [the Explainer Program] certainly helped me get to the place where I needed to be to make that decision."
(Male, 26-30, full-time business administration)

"The Explainer Program allowed me to learn my strengths and weaknesses. I learned in the Explainer Program that I was a strong communicator and presenter of information and decided to pursue degrees in criminal justice; social work; and statistics, which allow me to utilize those strengths."
(Female, 20-25, full-time in public and social services)

Skills, Abilities, and Behaviors

Drawing on Skills in Daily Life

In the online survey, alumni were asked to report how much they still use what they gained or learned from their experiences in the SCL Program. The responses showed that those experiences and lessons continue to have a substantial impact on the day-to-day life and work of alumni, with 62% (n=102) of respondents indicated frequent use of what they learned as an Explainer, while 34% claimed they somewhat draw on that learning (Table 16). Only 7 respondents (5%) reported they drew on their SCL experiences very little or not at all.

Table 16. Responses to how much alumni still use what they gained/learned from experiences in the SCL Program (n=164)

	Percentage	Count
Not at all	1%	1
Very little	4%	6
Somewhat	34%	55
Very much	62%	102

There were some significant differences in how strongly particular sub-groups of alumni responded to this question. There were no differences based on length of involvement in the program. Similarly, there were no significant differences based on working in a STEM field or working as a classroom teacher. However, there was a substantial difference between alumni who are currently NYHOS employees (96% of NYHOS employees reported they use what they learned *very much*) and those who are not (56% of non-NYHOS employees reported they use what they learned *very much*) (p=.004). This difference seemed logical because current NYHOS employees are in a work environment that requires them to draw daily on those experiences.

The responses to the open-ended question where alumni explained the ways in which they continued to draw upon their experiences in the program were coded and their frequency is presented in Table 17. Most frequently, it appeared that people draw upon the communication skills (26%, n=42) and the teaching skills and techniques (21%, n=34). The next most frequently mentioned items were science knowledge and concepts learned (17%, n=28) and social or interpersonal skills (15%, n=24).

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Table 17. Coded responses to what types of things alumni still draw upon from experiences in the SCL Program (n=164)

	Percentage	Count
Communication Skills	26%	42
Teaching and Education Skills/Techniques	21%	34
Science Knowledge/Concepts	17%	28
Social Skills	15%	24
Management/Leadership Skills	4%	7
Work Ethic	2%	4
Critical Thinking Skills	1%	2
Other	10%	17

*Multiple responses allowed. May total more than 100%.

Improvement of Skills, Abilities, and Confidence

In the online survey, alumni were asked to reflect on the program and rate how much their participation contributed to improvement in their self-confidence, skills, and abilities in several areas of interest. These areas included communication, teaching, critical thinking, problem solving, and general self-confidence. The results of alumni responses to these questions are presented in Table 18.

Overall, these data show that the program had the greatest impact in improving participants' teaching and communication abilities and confidence. The items receiving the highest ratings by alumni included:
- Confidence in ability to teach others (mean: 4.29, 83% reported *much improvement* or *great deal of improvement*)
- Confidence in talking to new people (mean: 4.24, 79% reported *much improvement* or *great deal of improvement*)
- Ability to interact with people (mean: 4.23, 80% reported *much improvement* or *great deal of improvement*)

Further illustrating this strong indication of impact, in response to each of these three items, approximately half of the respondents selected the top category of impact, indicating that the program led to *a great deal of improvement* in building their confidence and skills in these facets of communication and interpersonal interaction.

The program also appeared to have a strong impact on improving specific types of communication skills because these items were the next highest rated, with over one-third of the sample rating that there was *a great deal of improvement* due to the program in each area. Specifically, these were:

- Confidence in talking about science (mean: 4.11, 74% *much improvement* or *great deal of improvement*)
- Ability to communicate ideas effectively (mean: 4.07, 73% *much improvement* or *great deal of improvement*)

Table 18. Respondents' ratings of how much being an Explainer helped improve their confidence or abilities in specific areas (n=164). Ratings receiving the highest frequencies are highlighted.

	Percentage Responding					Mean
	A great deal of improvement	Much improvement	Some improvement	Very little improvement	No improvement	
Confidence in your ability to teach others	48%	35%	13%	3%	0%	4.29
Confidence in talking to new people	50%	29%	16%	4%	1%	4.24
Ability to interact with people	48%	32%	16%	4%	0%	4.23
Confidence in talking about science	39%	35%	23%	2%	0%	4.11
Ability to communicate ideas effectively	38%	35%	21%	4%	1%	4.07
Your self-confidence overall	34%	32%	26%	7%	1%	3.91
Confidence as a student/learner	34%	29%	30%	7%	1%	3.87
Ability to think creatively	30%	24%	30%	11%	4%	3.65
Ability to analyze a problem and find solutions	27%	24%	36%	9%	4%	3.62
Ability to ask critical questions	27%	21%	38%	10%	2%	3.61
Confidence in your ability to succeed in life	26%	26%	35%	10%	4%	3.60

Generally, statements related to improvement in self-confidence received higher ratings than statements about improvement in specific skills and abilities. Improvement in overall self-confidence was rated as having *much* or *a great deal of improvement* by 66% of respondents (mean: 3.91), and improvement in confidence as a student/learner was rated in this way by 63% of respondents to the survey (mean: 3.87).

Abilities related to critical thinking and problem solving received a more moderate response from alumni in terms of the SCL Program's influence in improving these skills. To statements about abilities to *think creatively*, *analyze a problem and find solutions*, and *ask critical questions*, around one-third of respondents indicated the program led to only *some improvement* in these skills. While close to one-half of respondents did indicate *a great deal of improvement* in these areas, these results were substantially lower than the extremely high ratings for communication skills and confidence. A statement about the program's influence on alumni's confidence in their ability to succeed in life was rated at a similar moderate level. It is possible that these were all skills and abilities that, while fostered and grown by the program, were possibly more greatly influenced by other factors or situations in the participant's life.

There were no significant differences in ratings by current NYHOS employees, nor were there significant differences based upon length of involvement with the program. These comparisons suggest that the long-term perception of impact of the program is relatively stable and consistent across alumni, regardless of their level of involvement with the program.

While the survey data provided an understanding of the relative impact of the SCL Program on individuals' growth and development in these key areas of confidence, ability, and skill, the

follow-up interviews allowed researchers to probe for greater depth to understand the ways in which the program tangibly helped them improve their abilities.

Communication Skills

General Communication Skills

Alumni repeatedly mentioned that the communication skills developed through the program had a lasting impact on their lives. They reported that they draw on these skills regularly. Many recognized the general, lifelong career value of having developed the ability to communicate a message clearly and effectively, which they draw from their experience as an Explainer.

> "Being an Explainer teaches you the importance of communication, which I strongly believe is vital to about any job I will ever have. Even in the world of business, you are always trying to communicate a message to your customers. I feel the NYHOS gave me a great starting opportunity to have a job. It was my very first job and looking back at now, I do not think I could have had a better opportunity."
> (Male, 20-25, undergraduate student, works full-time in an informal learning)

> "Definitely trains people in how to speak to others, for example, one of the techniques I learned, we talked about not knowing an answer, and instead of telling them you don't know, tell them 'let's find out together,' and I find that I still do that today when I am teaching."
> (Female, 20-25, undergraduate student in political science/history, ten-year goal: lawyer)

> "Along with a lot of scientific knowledge gained at the New York Hall of Science; I also learned how to be a good communicator. As a pharmacist; I will need to be able to communicate with all different types of people and the New York Hall of Science gave me a foundation for developing the skills I need to have a successful career."
> (Female, 20-25, graduate student in medicine/health, ten-year goal: research, work in a community practice)

One interviewee described witnessing how the program helped another Explainer, for whom English was a second language. She reported that it improved the Explainer's ability to speak English, giving her more confidence, and eventually encouraging her to serve as a translator for others.

> "This one girl, she was so shy and she felt she appeared dumb, but when I left she was laughing and talking with everyone. Her English overall improved so much and she was really happy to be there. She would translate to people who didn't know English, so it's something open to everyone."
> (Female, 31-35, full-time information technology)

Communicating to a Variety of Audiences

Others described the impact of the program on their communication skills in more specific terms. They described learning how to communicate to a wide variety of audiences. They felt the program helped them learn key communication skills needed to assess and engage a wide range of audiences. This learning included flexibility of communication approach, attentiveness to audience response, adjusting a message to suit audience knowledge, and other specific skills.

"Sometimes I would be able to connect with people and other times there was dead silence…I learned how to improvise. I was always okay at it, but the Hall helped me be in the moment. Each demo that you do is a different setting with different people; if they are 4 years old, you can't start talking about photons."
(Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

"Yes, it really helped me practice talking about science to non-scientists. I think it really helped to realize the importance of that and develop those skills."
(Male, 20-25, graduate student in chemistry, ten-year goal: science policy)

"I really like the training, the weekly training, I was assigned an exhibit and them had to explain it to my group, and you don't just say what is on the plaque, have to make it new, exciting, and relevant, and also with the demonstrating, you have a wide audience and need to keep it interesting for the scientists, and make it riveting for the little kids at the same time."
(Female, 20-25, undergraduate student in humanities, ten-year goal: work at New Yorker)

Sharing Science with Their Children

One unanticipated outcome that came out of several alumni interviews was the impact the program had on their current role as parents. In these interviews, alumni indicated that they have used or plan to use the techniques and lessons from their days as an Explainer to teach their own children as they grow and learn. They phrased this impact in terms of having gained skills that make it easier for them to explain things and help their children understand things better. This example demonstrates the wide ranging applicability of these communication skills in the long-term.

"Now that I have small children, I'm able to explain things to them, and they're able to grasp things. If I didn't have the experience from the Explainers, maybe they wouldn't understand them."
(Female, 26-30, stay-at-home parent)

"I have a daughter and a son (2 years and 6 months), so I share with my wife. My kids are too young, but I will definitely be teaching them when they are older. I also share with my father."
(Male, 20-25, undergraduate student in information technology, works full-time in information technology, ten-year goal: business owner)

"I used to have problems visualizing things in 3D, and they [older Explainers] would say look in this corner at an exhibit and imagine the cube coming out – and then they would help me understand it. And now, if I have to help my son doing a formula I use that."
(Female, 36-40, full-time engineer, stay-at-home parent)

Self-Confidence

The development of self-confidence, as seen in the survey results, was an area that resonated quite strongly with the alumni. Even more than is seen in the survey respondents, a large majority of the interviewees brought up specific ways in which the program helped develop their

self-confidence. It seemed that while confidence-building was a very common impact of the program, the area in which confidence was developed varied depending on the individual.

Overcoming Shyness: Confidence to Speak to People

Alumni who entered the program as shy, timid, or reserved often stated that the SCL Program helped them develop confidence in interacting with other people in any form, often in a way they describe as life-changing. These alumni indicate that through the training, the encouragement of program leaders, and the practice of working in an environment where talking with strangers is central to the job, they were able to develop their abilities. More importantly they also became less nervous about interacting with new people. This was notable because it demonstrated that the program helped shy people overcome their fear of both one-on-one interactions and speaking in large group settings.

> "Definitely, I think I was shy. I would only talk if I really knew you. I would freeze up in a crowd. I didn't want to say anything the first few times, I was very nervous. Part of the job was, in the summer time, school groups come in and in the beginning you are supposed to go on the bus and tell them the rules, just the general rules and simple as that. But talking out loud made me very nervous, but now I able to speak in front of people."
> (Female, 31-35, full-time information technology)

Some people felt that the experience had a direct impact on their personality. They felt that the program allowed them to become more assertive and outspoken, capable of voicing their opinions and increasing their success in social interactions with new people.

> "Definitely taught me to be more assertive… it taught me to stand up for myself. Before, if the idea was stupid I would just go along with other people's ideas."
> (Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

> "It's made me more outspoken. I would not be talking to you [the interviewer] right now if not for that. It made me an outgoing person. Not to be afraid to approach people. Even in talking for a group of people, present a project in front of people. …I'm a completely a different person because of that [being an Explainer]. I wouldn't talk to people. Really. I didn't talk to people I knew, let alone talking to strangers and asking if they need help with the exhibit. I worked there for 10 years, over a period that really changed me."
> (Female, 36-40, full-time engineer, stay-at-home parent)

Confidence in Public Speaking

Some alumni felt that the program helped increase their confidence with public speaking and their skills presenting information to a group. While there are similarities to the results reported above, these impacts were more specifically focused on development of confidence and reduced nervousness in public speaking settings and when they were addressing large groups of people. Some examples included the need to produce presentations for school or for work. They felt that their involvement with the SCL Program gave them the confidence to succeed.

"When it comes to presentations on a PowerPoint, it's not as nerve wracking, and I am more relaxed now. Sometime during a presentation you could see me shaking, and now I am more calm about it."
(Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

Self-Confidence for the Future

In addition to confidence as a public speaker, several alumni stressed ways in which the SCL Program helped them develop a sense of self-efficacy that laid the groundwork for their belief that they could succeed in all aspects of their lives. While the survey results did not suggest this was an impact for the entire group, for some, the program's ladder structure instilled a sense of confidence in the ability to achieve in the future.

"The knowledge and confidence that I can be successful at a vocation, so long as I put in the work. In addition; I think it made me more comfortable in my own skin in both my personal and professional life."
(Male, 20-25, graduate student in science/medicine, ten-year goal: work in school or clinic)

"It was the inherent, the feedback system, the training, you know how you're doing, and the demos. You could quantify how you were doing. And they build in the ladder system. I appreciated how clear it was and I felt like, even in the work field, if I work hard, I would succeed. It was very reassuring."
(Female, 20-25, undergraduate student in humanities, ten-year goal: work at *New Yorker*)

Others entered the program with low confidence in their ability to understand science, having decided based on school experiences that this was not their aptitude. These individuals felt that the program helped them to develop greater confidence in their ability to learn, understand, and excel in the sciences. This is addressed in greater detail in the Science Literacy section of this report.

"Science, and just the aspect of knowing that even thought it wasn't my strength, that if I applied myself to it and given the right support – which there was through the training and the support staff – I was able to excel in it even though it wasn't my area of strength."
(Female, 26-30, stay-at-home parent)

Interpersonal Skills

Patience and Managing Challenging Situations

A good number of alumni also felt that working as an Explainer helped them to develop stronger interpersonal skills. This frequently mentioned impact went beyond the development of communication skills to include development of skills, techniques, and abilities to positively deal with challenging situations and interactions with people. These skills included conflict resolution, patience, and dealing with challenging people and personalities. Alumni described these interpersonal skills developing through interactions with challenging situations presented by visitors to NYHOS.

"[I learned] how to be tolerant. You run into angry people and you have to keep your composure and not represent the org in a negative way. It was the first real job I had dealing with the general public."
(Male, 20-25, undergraduate student in electrical engineering, ten-year goal: work for power company)

"And you have to deal with people interrupting, you want to throttle them but it taught me to be patient. So, interpersonal skills were enhanced. I was outgoing before, but there was refining of those skills…. It was the audience, some visitors that were kind of mean; I had to make sure not to lose my temper too much. If this was outside they would hear my opinion, but instead, I count to 10 and explain without losing it. I understood why they were so adamant about things, like this woman wanted a band aid for her kid, and I said, 'give me some time, I need to ask someone from public programs, but I see where you are coming from, now look at my side.'"
(Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

R: I am the primary person at work for training. I am the first preference because I have the most amount of patience, I don't get annoyed.
I: Was patience something you learned at the Hall as well?
R: Patience and people skills all of them.
(Female, 31-35, full-time information technology)

Appreciation of Diversity

While it was not a focus of the study's questions or interviews, at least one alumna did indicate that working with such a diverse group of co-workers in the SCL Program opened her eyes to people from a variety of backgrounds and contexts. She felt this experience helped her to become less judgmental of others.

"At the Hall I was working with people on college who had a really different life than I had. I just hung out with them and their lives were completely different, they had to work to support themselves. Also most of the people that worked there were Hispanic people, it was very diverse. I am definitely more open to other people now. I definitely judge people less."
(Female, 20-25, undergraduate student in health science, ten-year goal: nurse practitioner)

Critical Thinking and Problem-Solving Skills

Critical Thinking

Although these items received more moderate responses on the web survey, alumni did describe how the program helped them develop critical thinking skills. This seemed to grow out of the skills developed while learning how to explain exhibits to audiences. Alumni reported using these skills to improve their understanding of a topic, situation, or concept. For these respondents, the skills remain useful today.

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"I'm more analytical [now] and can better form my own opinions on things whether its science; politics; religion; or personal problems.   I realized more that science is all around us and understanding how they work gives you confidence in life."
(Male, 26-30, undergraduate student in biology and education, ten-year goal: teacher or science research)

"To wrap your mind around the exhibits, you had to learn how to ask questions within the training. I learned how to ask critical questions. I didn't understand many of the exhibits. It didn't come second nature to me. … Had to go the extra mile and ask more critical questions during training to be sure I understood. All along the same lines, you're given a set of tools to ask the right questions see things from different angles. I had a skill set coming in, and the Explainer Program fine tuned certain abilities."
(Female, 26-30, stay-at-home parent)

"When you're figuring out how to explain things, you need to understand it yourself first. I guess you need to try to anticipate the questions and that helps you understand everything completely."
(Male, 20-25, graduate student in chemistry, ten-year goal: science policy)

Problem Solving

Alumni were also able to detail various problem-solving strategies developed as Explainers, which have carried through into their lives and careers. One such strategy was the ability, when faced with a problem, to break it down to understand its cause and find a solution. Interestingly, this strategy seemed to grow out of a communication strategy taught by the SCL Program: breaking down information into pieces to help the learner to understand it. The former Explainer below describes how he has translated this communication strategy into a problem-solving strategy:

"You think more about breaking it down to their level. It helped me break things down to the bear problems. Here, where I work now, breaking down to the smallest problem really helps. People here have so much experience, but they tend to forget the small things, and that's what usually is the problem. Take care of the small things and everything else works."
(Male, 20-25, undergraduate student in information technology, works full-time in information technology, ten-year goal: business owner)

The ability to think creatively or from multiple perspectives was another problem-solving strategy described in several of the interviews. These alumni described how approaching a problem from different routes and with different mindsets could be beneficial. They reported they continue to use this problem-solving strategy in their lives, schools, and career. They indicated that these skills grew out of communication strategies learned as Explainers. While at NYHOS, the alumni had to consider multiple perspectives of visitors and find the best way to communicate information to any given individual. This practice provided a foundation of skills that they could translate in other areas of life.

"To me, I was able to see other points of view. Or if a problem was presented I was able to think outside the box and think of two or three other ways to solve a problem, doesn't have to be one solution or one pathway. Besides that, also thinking creatively in a group. …Last year, me and a couple officers were planning a multi cultural event, and we had

too many ideas; we needed to trim down. How can we combine things? Looked at points that were related, and it took a lot of thinking and time to think about, how do we do this or that? What would be the direct and indirect consequences?"
(Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

"One thing to see the exhibit, but it's different to think about things in another way. How you might explain it. Like an analogy, putting things another way. … I guess approaching a problem in different ways. Math-wise or physics-wise, I was able to solve a problem in two different ways instead of one way. Not something someone asked me to do, but something that I learned. Come across a problem in calculus, might be another way to do something. Many times I would try to find another way."
(Female, 36-40, full-time engineer, stay-at-home parent)

Professional and Leadership Skills

Alumni also talked about how the SCL Program helped them develop leadership skills and experiences that served them after participation and how those skills may continue to be useful in the future. These skills seemed to be extensions of the interpersonal skills gained from interacting with visitors, as well as skills they gained from interacting with and managing other Explainers. This was particularly true of those who had progressed to higher levels of the Science Career Ladder (e.g., Program Explainer or Senior Explainer) while with the program. At these higher levels, leadership development stands out even more strongly in their minds as an impact. The types of leadership skills that alumni described included clear communication with staff, creating staff schedules, delegating tasks, learning from others, and carefully creating a sense of authority.

"I've been told by my staff that I'm the best boss they've had; and that's because of what I learned managing the Explainers when I was the Senior Explainer. I know how to explain situations to the staff to make sure they have a clear understanding of our goals. I know how to organize and schedule activities (create timelines) because we had to do that as a Senior Explainer."
(Male, 36-40, full-time in public and social services, graduate student in business administration, ten-year goal: president or VP of an institution)

"I worked there for 4 years, and was growing up in general and becoming more articulate, by my 2nd year I was comfortable with all that stuff, I was promoted to Program Explainer and I was younger than those I was leading, how do I relate to my peers? See me as younger and authority? I had to work out how to do that delicately.
[later in the interview]
Leadership, my ability to delegate tasks, I was also the editor of the Spectrum, the newsletter, it taught me to not take on everything myself and work with others, group work."
(Female, 20-25, undergraduate student in humanities, ten-year goal: work at *New Yorker*)

"I have used my leadership skills to go on the organize events, lead group discussions and be a project leader at school, and overall am more confident in interacting with others. My experience taught me how to listen and learn from others, whether it be a problem a visitor was having to learning a new science concept. I also learnt how to be more resourceful, having had to think quickly when faced with a problem with a visitor or

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exhibit. I enjoyed and loved every moment of my experience at the NYHOS, and feel the lessons I learned there to be invaluable.”
(Female, under 20, high school student, ten-year goal: work in a hospital)

Pre-existing Skills and Abilities

Finally, as noted with academic and career ambitions, impacts in skills and abilities varied across individuals. Alumni clearly indicated whether a skill or competency area was not influenced by the SCL Program during the interviews and through their responses to the questionnaire. When asked about these low areas of impact in interviews, in nearly all cases it was because they felt they came into the program with a pre-existing, well-developed strength. This type of comment, as illustrated by the examples below, was seen across virtually all of the areas of impact in this study. Alumni were aware of the strengths and weaknesses with which they entered the program, and they primarily experienced impact and growth in their weaker areas.

“I was always able to communicate. I never lacked in that department.”
(Female, 26-30, stay-at-home parent)

“I am pretty confident and headstrong; those are not big issues for me, especially with science, which I like. I am pretty much confident in my abilities.”
(Male, 20-25, undergraduate student in information technology, works full-time in information technology, ten-year goal: business owner)

“I don’t want to sound cocky, but I am a confident person. I didn’t have an issue with confidence, but in terms of science, if definitely improved my confidence in talking about science.”
(Female, 31-35, full-time classroom teacher)

Science Literacy and Engagement

The impact area of science literacy and engagement encompassed a number of concepts, all of which sought to explore the long-term impact on alumni’s perceptions, attitudes, and behaviors related to science, informal learning, and lifelong interest in learning. In contrast with the topic of science knowledge gains explored earlier, this impact area addresses how the program encouraged participants to become engaged with science topics, scientific thinking, and curiosity about the world, and how that engagement translates into thought processes, attitudes, and behaviors following participation. The results of the survey and interviews showed that changes in thinking and values did occur for many participants. The interviews demonstrated that they are aware and continue to feel the effects of SCL involvement.

Engagement in Lifelong Learning

In the online survey, alumni were asked to report how frequently they engage in various activities related to lifelong science learning. These activities ranged from visiting science museums to reading about science to watching science television. The most common current alumni activities include: *watching television programs about science*; *talking to family or friends about science issues*; and *reading science articles in magazines or online*. Over 60% of the alumni participated in these activities once a month or more (see Table 19). In addition, 76%

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reported that they visit informal science learning settings, such as science museums, planetariums, and zoos, several times a year. Past national surveys have shown that 60% of the general American public and 76% of college graduates have visited an informal science institution within the year prior to the survey (National Science Board, 2008). While the measures differ from those used in the alumni survey, this comparison suggests that SCL alumni are at least on par with, and perhaps surpass, the visitation rate of college educated adults and are well above the average for the general public.

Table 19. Frequency with which alumni report that they engage in various science-related lifelong learning activities (n=164).

	Percent Responding					Mean
	Very Frequently[1]	Frequently[2]	Occasionally[3]	Rarely[4]	Never	
Watch documentaries or TV shows about science	30%	37%	26%	6%	1%	3.88
Talk to family or friends about science-related issues	36%	24%	29%	9%	2%	3.82
Read science-related articles in newspapers, magazines, websites, blogs, or journals	30%	35%	24%	8%	4%	3.79
Visit science museums, planetariums, zoos, etc.	5%	19%	52%	21%	3%	3.02
Read a science-related book	13%	15%	30%	31%	11%	2.90
Listen to radio shows or podcasts about science	6%	11%	23%	26%	35%	2.27
Go to public lectures on science-related topics	4%	7%	22%	34%	34%	2.13

[1]Defined in survey as: At least once a week   [3]Defined in survey as: Several times a year
[2]Defined in survey as: Every one or two months   [4]Defined in survey as: Once a year or less

The activities that alumni tend not to engage in regularly included *attending public lectures on science* (34% never; 34% rarely) and *listening to radio or podcasts about science* (35% never; 26% rarely). Reading science books fell in the moderate range of frequency, with participants occasionally or rarely participating in this activity.

Interestingly, there were no significant differences in the responses of current NYHOS employees and other program alumni. There were significant differences based on length of involvement with the program, with those who had had the shortest involvement in the program (0-6 months and 6 months – 2 years) reporting that they engaging in the activities of *reading a science book*, *attending a lecture*, or *talking about science with family/friends* slightly more frequently than those who were involved with the SCL Program for a longer length of time (p<.05). Possible reasons for this difference remain unclear.

In follow-up interviews, participants explained how their involvement with the program helped them develop new mindsets and behaviors associated with lifelong learning. The process of inquiry-based learning, the need to learn new things on an ongoing basis, and tapping into people's curiosity and interests as part of the SCL Program all seemed to promote the adoption

of habits of mind and behavior that demonstrated the degree to which they value lifelong learning and curiosity. These values appear to have extended beyond science to encompass all aspects of life.

> "At the Hall there are new exhibits coming in every month, I would learn a lot more about those things too. Just learning in any way; that is something I would like to be doing the rest of my life."
> (Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

> R: They have a research library at the Hall too. Once I was doing the cow eye demonstration, providing the simple knowledge and this guy asks me a very advanced question. I didn't know the answer, but I told him I can get back to you. The next thing, we went to the research library and open the encyclopedia and got the answer and approached the visitors and he was very impressed. So we try to give them the best answer.
> I: Do you still seek information about questions you're interested in today?
> R: Before the Hall, I wouldn't have cared. Now if I get a question at work, I won't get a good sleep unless I find the answer.
> (Female, 31-35, full-time information technology)

> "I would say it's made me want to educate myself more on anything that has my interest at the moment. Right now I am majoring in art and I'm really educating myself on the history of the paintings and the artists… In a small way, having to study up on the demos, it also made me look deeper into the art aspect as well. I was just interested in doing painting and not really that interested in the history of art."
> (Male, 26-30, undergraduate student in art and art history, ten-year goal: work at MoMA)

Interests in Science and Teaching

In the online survey, alumni were asked to think about themselves before and after they were involved in the SCL Program, and then to reflect on whether their interest in several topics or activities increased or decreased based on their participation in the program. These topics and activities included those most supported by the SCL Program, such as learning and teaching.

Overall, interest increased for a majority of participants in every area (Table 20). The greatest increase was in *sharing what I know with others*, which 80% of respondents indicated they were more interested in doing after they had been Explainers. This corresponds to the earlier findings about increase in abilities to communicate and share information, as well as suggesting a desire to communicate these interesting findings to an audience, which was confirmed in follow-up interviews.

Interest in *visiting museums* increased for 73% (n=119) of respondents, interest in *science* increased for 72% (n=118), interest in *teaching* for 70% (n=115), and interest in *thinking about science issues* for 73% (n=119). These numbers demonstrate that the program has substantial impact on the participants. Also of note, for each of these activities, around one-quarter of respondents indicated that their interest stayed about the same. Similar to the findings reported earlier, nearly half of the sample indicated their interest in *going further in their education*

remained about the same, especially for those who entered the program with a pre-existing high interest in science, teaching, and academic goals.

Table 20.. Increase in alumni interest in science, teaching, and informal learning following involvement in the SCL Program (n=164)

	Percent Responding					Mean
	Much more interested	A little more interested	About the same	A little less interested	Much less interested	
Sharing what I know with others	36%	46%	18%	-	-	4.18
Visiting museums	34%	39%	26%	1%	-	4.05
Science	27%	45%	27%	1%	-	3.98
Teaching	35%	35%	24%	6%	1%	3.97
Thinking about science topics and issues	27%	46%	25%	2%	-	3.97
Reading/watching science stories on news, TV, radio, the Internet, etc.	27%	38%	34%	-	-	3.93
Going further in my education	32%	20%	49%	-	-	3.83

There were no significant differences in responses based on how long a respondent was active in the program. However, this was one of the few areas where current NYHOS employees rated higher interest levels than other alumni. Current NYHOS employees had greater increased interest than other alumni in the areas of *science*, *teaching*, *thinking about science issues*, *reading/watching science stories*, and *going further in their education* (p<.05) (see Table 21). The strength of increase in these science and education interests seem to have a connection with continued employment with the NYHOS, whether that employment comes as a result of their increased interest or if their interest continues to be fostered by working in the NYHOS environment.

Table 21. Comparison of significantly different mean ratings of increase/decrease of interest by NYHOS Staff and other alumni

	Mean	
	NYHOS Staff (n=24)	Non NYHOS Staff (n=140)
Thinking about science topics and issues***	4.50	3.88
Reading/watching science stories on news, TV, radio, the Internet, etc.***	4.46	3.84
Science**	4.42	3.91
Teaching*	4.42	3.89
Going further in my education*	4.17	3.77

*p<.05   **p<.01   ***p<.001

In follow-up interviews, some respondents confirmed the survey results by describing how their negative views on science changed to a more positive attitude because of their involvement in

the SCL Program. This finding was similar to the results presented about the contrast between school science experiences and the more transformative experiences that appeared to be a result of the programs at the NYHOS.

> "It changed my attitude about science. I am the kind of person who, if I make a choice or a decision, if I don't like a person, I am not going to change my mind.   And working at a museum, even after a few days, it was so different from how I was I brought up, where I just read about it, or did the science fair in elementary. Those were not good experiences. The Hall was fun."
> (Female, 31-35, full-time classroom teacher)

> "Yeah, definitely [the program changed my attitude about science]. I wasn't geared toward science before. I was in the Humanities before. I was a History major with a Mythology minor. Science was not something I enjoyed before. It took me out of my comfort zone. Made me appreciate science. And then, that I could explain these things to other people."
> (Female, 26-30, stay-at-home parent)

Science as a Relevant Part of Life

In addition to increasing alumni's interest in science and lifelong learning of science, this evaluation sought to better understand the role that engagement with scientific topics and issues plays in the lives of program alumni. Survey results suggest that being an Explainer leads to more frequent attention to science and participation in conversations about science in daily life (Table 22). The greatest impact seemed to be related to the greater frequency of noticing science in everyday life, with 82% of responding alumni indicating that this awareness is more common after being an Explainer. Additionally, there was an increase in having conversations about science topics and events among many alumni (70%).

Table 22. Increase in frequency of the role of science in everyday life among alumni (n=164)

	Percentage Responding					Mean
	Much more often	A little more often	About the same	A little less often	Much less often	
Notice science in everyday life	35%	47%	18%	--	--	4.16
Have conversations about science topics or events	30%	40%	29%	2%	--	3.98

Responses to the prompt *having conversations about science topics or events*, revealed significant differences between current NYHOS employees and others. Current staff rated a slightly greater increase in this topic (mean: 4.38) than other alumni (mean: 3.91) (p=.009). Given the location of their employment, where science conversations are likely a part of daily work life, such differences are not surprising. There were no significant differences based on length of time in the program.

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The interviews and responses to open-ended questions in the survey provided data for a more comprehensive understanding of how the SCL Program influenced the scientific mindset and engagement of alumni.

Increased Curiosity and Desire to Understand

Some alumni described how their participation changed the way they approach new information and experiences. Some attributed an increase in their curiosity and inquiry about the world around them to their experience in the program. This seemed to include development of wonder and the desire to seek out information about why things work the way they do, rather than accepting an explanation at face value.

> "I do something totally different today; I am a number cruncher. So in my daily life, no [I don't use science]. But recreationally, yes. I watch the Discovery Channel, History [Channel] more often than I would had I not had that experience. I tend to see things in a different light, a more scientific light; I have a more comprehensive understanding, and am constantly curious about how things work. I had that before, but it certainly expanded at the Hall."
> (Male, 26-30, full-time business administration)

> "Definitely, it made me – whenever I learn something new, I always make sure to understand every piece. Before I was memorizing formulas and now I make sure I understood why things work the way they do. I try to understand the big things and the little things."
> (Female, 20-25, undergraduate student in health science, ten-year goal: nurse practitioner)

> "Everyday things that I encounter, I start wondering, how can it be different, or the science behind it. I also tend to want to explain things to people. I also use the communication skills I gained to get my ideas across effectively."
> (Male, 20-25, community college student in education, works part-time in an informal learning)
> "I really enjoy learning new things. Right now I am interested in energy, alternative energy and the new policy, carbon dioxide emissions, alternative fuels, things like that. Most academic funding comes from the government, the stimulus plan is bringing more money, the economy isn't hurting us, but it's going to take a while for the affects of those policies to filter down. If anything, there is likely more money for science."
> (Male, 20-25, graduate student in chemistry, ten-year goal: science policy)

Making Science Connections in Everyday Life

Many respondents talked about how they continue to use science in their daily lives. This finding included descriptions about how they strive to increase their understanding and awareness of the science behind everything around them. Descriptions ranged from thinking about science in contemporary and societal issues to day-to-day details of life, such as medical care for themselves and their families. It also included drawing connections to other fields of study, such as art or history. Explainer alumni often noted that they still draw connections to exhibits and lessons learned while in the program at NYHOS, as well as demonstrating their own commitment and extension of this learning to create a full worldview that includes science as an important part.

Understanding Societal Issues about Science

"I respect it because it explains a lot of things we need to understand. I always have more questions; there is always something else to find out… For one thing, evolution. That is highly controversial. People get heated up about it, and it's become so political. We need to look at the scientific basis, but the duality science and religion, and religion and politics is important to consider."
(Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

"That it [science] is very relevant in the news today. That we really can't live without science in our lives on some level. It just really touches our lives in every way. From technology to medicine for our children, in every aspect of our life, we take it for granted."
(Female, 26-30, stay-at-home parent)

Seeing and Understanding Science in Daily Life

"Learning and having an interest. Learning about medically related stuff. For example, when you are a child and get a cold and the doctor gives you antibiotics to take for a 7 day period, I never understood why you should take all of it.   And that came up while I worked there and I found out you may have killed some of the bacteria, but you still have some left behind. If you complete the course, it completely kills them. So just finding out why things happen. Now I take that extra step to find out more. I am total internet person."
(Female, 31-35, full-time information technology)

R: Sometimes, certain things… it comes up here and there, milk goes bad because there are microbes in it.
I: Do these moments come up often?
R: They [NYHOS] had a wide range, stuff with light, different colors, sports, philosophy. Right now I am working in carpentry and something I think about [from the museum] is in the playground, the see-saw. You get a lot more torque out if it the longer it is, makes it easier for you, longer is better. It's just physics. And I think about that, like, if I'm using a crowbar.
(Male, 26-30, full-time trade profession)

Incorporating Science in Other Fields

"The connection to art; I think it has always factored into looking at things in a new light, my general understanding of the world… For me it's not in terms of research or the way that scientific knowledge is gathered, more the theory. I enjoy using science as a lens. Anything falls into it. I love neuroscience, or the idea of vectors [in science]. You can also think of emotion as a vector. I mostly like the ideas and not the gathering [of scientific data]."
(Female, 20-25, undergraduate student in humanities, ten-year goal: work at *New Yorker*)

Commitment to Science Outreach

Among those alumni working in or entering the fields of science, technology, engineering, or mathematics, the ongoing connection with science was implicit in their careers. Some of these alumni also described how their experiences in the SCL Program helped them to recognize the value of maintaining a connection with the general public. Not only did their experiences in the SCL Program give them the communication skills necessary for sharing their passion with others, it also offered them an experience to recognize the value of giving back to their community as a way of increasing public interest and knowledge in science.

> R: I am very interested in interacting with non-scientists, because of how important it is.
> I: Why do you think it's important?
> R: Because of how important science is to modern life. That's kind of general, but it's so poorly understood by the public, people with science backgrounds need to explain what is known to those who don't have a science background.
> *[later in the interview]*
> R: I find teaching interesting. Again, it lets me practice talking to non scientists, get out of the grad community.
> (Male, 20-25, graduate student in chemistry, ten-year goal: science policy)

> "I now give lectures to high school students persuading them to major, [have a] career in science; mathematics; or engineering. I also create demonstrations in college for the electrical engineering open houses. The NY Hall of Science provided me with the necessary tools that I need to continue accomplishing my community outreach goals."
> (Male, 20-25, undergraduate student in electrical engineering, ten-year goal: work for power company)

> "The Explainer program improved my self-confidence and armed me with the foundation I needed to become a Biological Anthropology major. I graduated from <college name> with honors and continued on to <college name> for a Master's degree in Education and Technology. I am currently seeking a doctoral program that will allow me to research and develop technology to help inner city children develop science skills and hopefully a love of science that will encourage them to become the future scientists America so desperately needs."
> (Female, age not provided, science classroom teacher)

Program Design

The final area of study in this evaluation explored how alumni perceived the program's design in relation to their current motivations and the impacts derived from being part of the program.

Motivations for Involvement: Joining, Continuing, and Leaving the Program

Motivations for Joining the SCL Program

Alumni were asked to report the reasons that influenced their original decision to apply to the SCL Program. As Table 23 details, there was not a single dominant motivation for the majority of respondents. The *need to find a paying job* was cited by about one-quarter of alumni surveyed

(26%, n=42) as the primary reason that they applied, underscoring the importance of the salary component of the program. Looking at all the reasons alumni selected as influencing factors, we see that a majority were influenced by:

- Need/want a paying job (61%, n=100)
- Like science (55%, n=90)
- Told or encouraged to apply by someone (53%, n=87)
- It sounded like fun (53%, n=87)

Table 23. Reasons why alumni applied to the SCL Program (n=164)

	Primary Reason		All that Apply	
	Percentage	Count	Percentage	Count
I needed/wanted a paying job	26%	42	61%	100
I liked science	17%	28	55%	90
Someone told/encouraged me to apply	11%	18	53%	87
It sounded like fun	10%	16	53%	87
It had a flexible schedule	5%	8	46%	75
I knew someone who worked there	5%	9	30%	50
I liked teaching	5%	9	29%	48
It was better than other jobs I could have taken	7%	11	24%	40
It was just something to do	2%	4	9%	14
To be with friends or to meet new people	1%	1	26%	43
Other	11%	18	18%	29

Motivations for Continuing with the SCL Program

Alumni were also asked to report which factor(s) motivated them to continue working with the SCL Program. As shown in Table 24, there were more factors considered as motivators for retention than had led them to join in the first place. The enjoyment of learning and doing science rose to the top of the list of primary motivations for joining (21%, n=34). However, retention was associated with a variety of factors for 50% or more of respondents:

- It was fun (72%, n=118)
- Liked learning/doing science (70%, n=115)
- It felt comfortable to work there (70%, n=115)
- The flexible schedule (66%, n=108)
- Liked teaching (57%, n=93)
- Being with friends/co-workers (55%, n=91)
- Better than other available jobs (50%, n=82)

In the list of motivating reasons, *flexible schedule*, *teaching*, and *comparison to other jobs*, emerged as supportive factors for 50% or more of Explainers' continued involvement, but were the primary reason for continuation for only a few alumni. *Liking science*, *feeling comfortable*, *fun*, and the *social environment* remained the dominant motivators for most of the responding alumni.

Table 24. Reasons that motivated alumni to continue in the SCL Program (n=164)

	Primary Reason		All that Apply	
	Percentage	Count	Percentage	Count
I liked learning/doing science	21%	34	70%	115
It felt comfortable to work there	16%	27	70%	115
It was fun	12%	19	72%	118
Being with my friends / people I worked with	12%	19	55%	91
There was a chance for me to advance in the job	9%	14	40%	65
The paycheck	7%	12	35%	58
I liked teaching	7%	11	57%	93
The flexible schedule	5%	9	66%	108
It was better than other jobs I could have been doing	3%	5	50%	82
My supervisor(s) were nice to work for	3%	5	49%	81
It was something to do	1%	1	19%	31
Other	5%	8	4%	6

A comparison of retention motivators with motivations for joining revealed some notable differences. The most striking was the motivational power of the position being a paying job. While receiving a paycheck is an important factor that brings them to the program initially (61% selected overall; 26% most important), their involvement continued because of many other factors that seemed to prove more rewarding than the paycheck. Just over one-third (35%) indicated the paycheck was a motivation to continue, and only 7% indicated it was the primary reason they stayed in the program.

In follow-up interviews, alumni were able to describe in more detail how some of these factors influenced their experience and their desire to continue with the program.

Flexibility

> "The people made me feel very comfortable, coaching me, respecting the way things work. One time, I was really stressed out with college, I told them I needed to quit. I loved working there but I didn't have time. They said, 'well can you put in any hours?' So I quit, but he created a brand new position for me…whenever I had time, I would come in… when the semester was over and I had an easier load, I went back to 25 hours a week. One of the great things is that they encourage people to go to school, if you're not in school you can't be in the program; you have to have an intention to go to school."
> (Female, 31-35, full-time information technology)

> "At the time I was going to school full time, so the fact that I was able to work around my school schedules made it a lot easier. I couldn't find another job that would do that."
> (Male, 26-30, undergraduate student in art and art history, ten-year goal: work at MoMA)

Opportunity to Advance

> "I think the ladder, being promoted up the rungs, that was really helpful because it taught you that there are fair ways to move up. There has to be good report with the boss, but it's really how you prove yourself. If you have a weakness, you need to work on it, and if you show that you try, you will get rewarded."
> (Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

"The career ladder aspect, first you volunteer, and as you teach you to get better. That is something really important to know, that you don't just walk in and become a big shot. You work from the bottom up. Liked how training was peer teaches peer, it wasn't a book or a lecture, you learn by explaining and teaching each other."
(Female, 20-25, undergraduate student in health science, ten-year goal: nurse practitioner)

Teaching

"The best example, cow eye dissection, see the excitement in all the kids. That in itself, their reaction to that, made me want to keep doing it. Even after the 100th time, believe it or not."
(Male, 26-30, part-time retail and service industries)

"I think it [my motivation] changed in a sense that before, I was there more for myself, and I was learning for my knowledge. When we first went from our high school, it was about learning and gaining knowledge. Later, it was about sharing and giving knowledge. My role was changing. That kept me going."
(Female, 36-40, full-time engineer, stay-at-home parent)

Unique Working Atmosphere

"…before the Explainer Program I had jobs, working at doctor's offices, part-time jobs. So, the learning aspect of it [was what motivated me]. You don't get that in most jobs at that stage in life – high school or college. You're usually working retail or in an office. So, the learning aspect. You're constantly being educated. It's like a big school. That's really uncommon in part time jobs at that stage of life."
(Female, 26-30, stay-at-home parent)

Reasons for Leaving the SCL Program

Alumni were asked to report their primary reason for leaving the program, selecting from a list of nine options. We discovered that 26% of respondents selected the option of *other* and wrote in an explanation for leaving the program, feeling that the answer options did not sufficiently address their reason. These responses included a number of individuals who had taken another job elsewhere (but which they did not consider to be a "better opportunity," as was the wording in the survey), been promoted within NYHOS, or had entered their chosen professional field after college graduation. Others generally indicated that they left to attend school, although not specifically college (as worded in the survey). Consequently, the responses of those who selected "other" to this question were re-coded into appropriate revised categories shown in Table 25.

The majority of respondents left the SCL Program either to take another job outside of the Career Ladder itself (29%, n=47) or to attend school (24%, n=39) – whether that was going to college outside of the area or focusing on full-time studies in New York. These results suggest that the program achieved its stated goals as a Career Ladder, as it supported the majority of these participants to move onto further education or employment.

Table 25. Primary reason why alumni left the SCL Program (n=164)

	Percentage	Count
Another job / promotion / enter career field	29%	47
To attend school	24%	39
Hard to balance Explainer job and other commitments	18%	28
Needed higher pay	16%	26
Felt like there was no room for me to advance/grow	5%	8
Moving out of the area	2%	3
Issues with supervisors/leadership	2%	3
Bored with the job	1%	1
Issues with co-workers	1%	1
Other	3%	4

The most prevalent challenges that the responding alumni reported led them to leave the program were the difficulty of balancing the job at the NYHOS with other commitments and responsibilities (18%, n=28) and the need for a higher salary (16%, n=26). Other concerns, such as limited opportunities for advancement, boredom, or conflicts with supervisors or co-workers were indicated by only a handful of alumni.

Interestingly, this was one question where there was a noticeable difference in the responses based on length of involvement in the program. For those involved with the program the least amount of time (less than six months), 44% (n=7) reported that the balance of the Explainer job with other commitments was their primary reason for leaving, with leaving for school being the second most common reason given by this group (31%, n=5). In contrast, for those who were involved with the program the longest (four years or more), the main reasons for leaving were for another job or promotion (38%, n=15) or because they needed a job with a higher salary (23%, n=9). While leaving for school or to take another job/promotion are intended routes for exiting the program, the other data presented here suggest how barriers to participation in the program may change for participants over time.

While negative feedback was rare, some negative comments emerged in the open-ended questions on the survey and when alumni were pressed to describe negative aspects of the program in follow-up interviews. In these comments, a few participants raised concerns about supervisors or fairness of process which relate may have related to the reasons why several alumni chose to leave the program,

> "Some people were getting pay raises, and I never got evaluated. The way it works, you get evaluated and then get a raise. I was doing them and they never evaluated me, they do it by hours."
> (Male, 26-30, full-time trade profession)

> "A personal gripe, the drama with some of the higher-ups. I felt like they meant well, but at the same time (other agree with me), some didn't really deserve it [being promoted].

And that goes against the ladder. They don't really help us, but they were there before we got in."
(Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

Impact on Building and Lowering Confidence

The alumni were asked to recall and describe aspects of the program that helped build or lower their confidence during the interviews. They gave many examples of how the program's structure, leadership, and flexibility supported their intellectual growth, increased skills, and development of their sense of confidence. From these conversations, there emerged some themes about which aspects of the SCL Program were most successful in the support of Explainers' comfort and growth.

Training

One element that was cited by several alumni was the value of the training process that the SCL Program uses. The program's emphasis on regular training sessions, classes, and mentoring by senior staff was highlighted as something that contributed to participants' sense of confidence with the exhibits' science content and their ability to speak and communicate about those topics. There was an appreciation that the program was committed to helping them learn and demonstrate their content knowledge.

> "Classes, learning sessions, plenty of training. Lots of jobs don't give proper training. One of the things I don't like at my job is that I need to keep up with technology, and I am not given that time at work. It's crazy busy, so I have to use personal time to do it."
> (Female, 31-35, full-time information technology)

> "They were really big into making sure you knew what you were talking about, giving you more background information, so you could go out and really explain what was going on with more information than was on the sign."
> (Male, 20-25, undergraduate student in electrical engineering, ten-year goal: work for power company)

Peer Teaching

Many respondents felt that the program's use of peer teaching had a positive impact. They emphasized that Explainers learned as much from their program peers as they did from trainers, supervisors, or leadership. These responses gave the impression that everyone in the program was treated as both a learner and a teacher, and that one could learn a great deal from the perspectives of others.

> "The career ladder aspect, first you volunteer, and as you teach you to get better. That is something really important to know, that you don't just walk in and become a big shot. You work from the bottom up. Liked how training was peer teaches peer, it wasn't a book or a lecture, you learn by explaining and teaching each other."
> (Female, 20-25, undergraduate student in health science, ten-year goal: nurse practitioner)

"We had a lot of other college kids there too, working with us. I was in 10th or 11th grade.
We had older Explainers that would help us with our homework. If we had problem,
these were kids in Engineering school or Teaching school, and they would say why don't
you try it this way? … The influence of other people of our own age also helped."
(Female, 36-40, full-time engineer, stay-at-home parent)

"Working with peers, couching each other, there are 100 exhibits and you have a buddy
you travel with, you watch what they do, and you can have your own analogies and you
watch someone else and they might have a different analogy."
(Female, 31-35, full-time information technology)

Relatable Supervisors

A number of alumni reiterated the value of learning from supervisors and other program leaders
whose ages were very close to their own. They felt that they could relate better to their co-
workers and superiors because of the similarity in ages. This seemed to provide a level of
communication and team-building that may not be present in other jobs.

"Definitely, we all face the same thing every day; hordes of people and we had the same
goals. Being close in age is a big thing, now I am the youngest person, at work. I am 24.
And while I was there, there were people who were younger, looking at us asking what is
college like? It definitely helps to have a superior the same age. They relate you on the
level you need to relate on; no communication gap."
(Male, 20-25, undergraduate student in information technology, works full-time in
information technology, ten-year goal: business owner)

"…everyone appreciated that our supervisors could relate to us; they're not a 60 years
old. [They were] very close in age, 25 to 30, and they are grad students. And just having
someone that is very supportive, very understanding, with the right hint of firmness, so
many people could relate to them."
(Female, 20-25, undergraduate student in political science/history, ten-year goal: lawyer)

Supportive Environment

One of the most influential elements that contributed to the development of participants' sense of
confidence was the ways in which the program created a supportive environment. This included
sufficient training, acknowledgement of strengths, encouragement of abilities, and a sense of
fairness and respect given to all participants by everyone within the program.

Individual Support and Encouragement

"I was okay with small groups, but when the manager came to evaluate, I would freeze
up and I couldn't speak. I told my manager and one of the greatest things he did, he hid
out there and didn't tell me when he was evaluation. And I did pretty well and it went
pretty good! I was like 'Oh my god,' and I was certified. That is when really got my
nervousness out. You motivate, it helps out your confidence and it went beyond the
museums."
(Female, 31-35, full-time information technology)

"Yeah, tremendously, I didn't have a problem speaking in front of people, but I hesitated
for a year before I went for my first demonstration certification. When I went for

certification, the fire alarm went off, I remember, <a supervisor> came up to me and said, 'You speak so well, how come you didn't go sooner?' At that point I wasn't too confident in my speaking skills, but other people noticed it as well. I took advantage of it, the demos and just, knowing that people can understand what I am talking about coming up afterwards and telling me what a good job I did. It made me feel really confident in group interviews, things like that."
(Male, 26-30, undergraduate student in art and art history, ten-year goal: work at MoMA)

Opportunity to Try New Things and Succeed

"You can write your own script. Of course it has to be reviewed, but it's a wonderful opportunity to be a junior under someone with a license."
(Female, 31-35, full-time information technology)

"I can give you an example. They had a technology exhibit. I was in 10th or 11th grade at the time, and computers were new. I wanted to know how a hard drive works. So, my supervisor gave me a broken computer and said take it apart to see what was inside. That was cool for me. How does it relate to a hard drive working. Computers weren't as common then. That was kind of cool."
(Female, 36-40, full-time engineer, stay-at-home parent)

Fairness

"They respect other people accommodate everyone. It's the one place I have worked where I haven't seen favoritism. My manager now favors certain people, I know there is supposed to be equal opportunity everywhere, but it just isn't."
(Female, 31-35, full-time information technology)

"I think the ladder, being promoted up the rungs, that was really helpful because it taught you that there are fair ways to move up. There has to be good rapport with the boss, but it's really how you prove yourself. If you have a weakness, you need to work on it, and if you show that you try, you will get rewarded. Going up if you do well is a great thing."
(Female, under 20, undergraduate student: undecided, ten-year goal: non-profit or an informal learning)

Negative Impacts on Confidence

Very few alumni could describe anything about the program that lowered or hindered the development of confidence or comfort in the job. In the rare case where a negative issue was described, again, these issues pertained to an individuals' perceived of a lack of fairness in administration or an interpersonal problem with program leadership.

The other repeated comment that related to the program and development of self-confidence was the process of being evaluated. Evaluation was sometimes perceived as stressful and intimidating. The alumni recalled a sense of nervousness about being tested. However, alumni also understood the benefit of that nervousness and the usefulness of the process for helping them increase their knowledge, skills, preparation, and confidence

"The evaluation was intimidating. Evaluation of the Explainers. You're put on the spot to see what your knowledge was, and you had no idea what they were going to ask you. Where were they going to start or finish? You had to know your stuff. Which was good. But it was intimidating. People would cram when they thought they were coming. Nobody ever told us when evaluations, but when you saw your supervisor starting to talk to people and ask questions, you knew you could be on rotation."
(Female, 26-30, stay-at-home parent)

Social Dynamic of the SCL Program

Many of the results presented in this section have a common thread. Participants recognized the value of the positive social dynamic embedded in the structure of the program. Alumni repeatedly described the value of learning from their peers, from the unique support provided by peer supervisors within the ladder, and from building their relationships with one another. More than half (55%, n=90) of alumni surveyed felt that their relationships with their co-workers and friends motivated them to stay in the program. While this was not true for all participants (at least one interviewee reported that she had observed the social dynamics, but did not feel included), former Explainers described the group as a family, stating that they had developed lasting friendships.

"We were a tight group of people as Explainers. For the most part we grew up and experienced a lot of professional and social firsts at the Hall."
(Male, 36-40, full-time retail and service industries)

"The experience created many friends who I still am in touch with today. Most of my friends come from working at the Hall of Science."
(Male, 36-40, full-time in public and social services, graduate student in business administration, ten-year goal: president or VP of an institution)

"There are still people I am in contact with, old explainers from 1988 that I still keep in contact with."
(Male, over 40, full-time public and social services)

"There [at the Hall] they are going to feel like they are part of a family. …it's been so many years and they still keep in touch. There is a reunion every year, anyone who is an ex-employee, they have a free Mets game. They email job openings…. This way you are familiar, and that is really, really nice, it's the only company that keeps in touch, reaching out through email, constantly updating the database with our new contact information."
(Female, 31-35, full-time information technology)

CONCLUSIONS

These results demonstrate that the Science Career Ladder Program at the New York Hall of Science has achieved its goals in the range of impact areas defined for this study. It contributed positively to these participants' academic and professional development. While these results came from a self-selected group of program alumni who remain connected with NYHOS (27% response rate) and should be considered conservatively, this group most likely represents those participants who experienced the strongest positive impact, but that many non-responding alumni

most likely had similar experiences if not areas as strongly. The results showed that the program had a lasting impact on participants in each of the targeted areas long after they leave the program.

Academic Achievement

It is evident that many participants enter with well-defined goals of attaining advanced formal education, which they then achieve. For these participants, the program does not seem to influence their decisions or goals to pursue advanced education. What the results do show, however, is that the program impacts their achievement by helping them develop knowledge, skills, and confidence that they have successfully applied in academic settings. While specific skills vary between individuals, they include:
- Science knowledge that is used in science classes
- Development of study skills learning habits that are applied across subjects
- Increase in confidence and ability to give presentations and oral reports
- Problem-solving skills that allow participants to approach difficult concepts and subjects in new ways

In addition, there was some evidence that a subset of those who enter the program, arrive with less defined academic goals. For these individuals, the supportive network of fellow Explainers and supervisors appeared to provide role models, encouragement, and the support necessary for them to change their academic perspectives and consider new academic pursuits.

Career/Professional Development

Overall, the SCL Program had greater impact on shaping the career goals and directions of its participants than it did on their level of academic achievement. This impact manifested in different ways, depending on the program participant. For those who entered the program with some idea of their intended career path, the SCL environment provided them with an environment to test their ability through experiences that highlighted their strengths and weaknesses, confirmed their interests and passions, and provided them with novel encounters that revealed undiscovered potential.

The SCL environment seems to help participants become more confident in their chosen path, whether that confidence confirms their original intentions or reveals a new direction that is more suited to their skills and interests. While the program's alumni appear to remain committed to the fields of science and education, the program also appears to help some participants clarify their career directions outside of the sciences or education. In either case, the program appears to support participants as they develop the confidence to pursue their own dreams.

Skills, Abilities, and Behaviors

One of the strongest impacts the program seems to be on participants' development of skills, abilities, and behaviors that they continue to use in their lives and careers long after participation. Alumni clearly believe that they continue to draw on their experiences as Explainers. Even after many years, alumni can describe the specific skills they developed as an Explainer and how they

continue to use those skills in their daily lives:

- Communication – Key skills highlighted included the abilities to communicate effectively, to present an idea clearly, to assess an audience and adjust communication accordingly, and, in some cases, to help their own children understand the world.

- Self-Confidence – The concept of confidence was intertwined with other areas of impact, including academic achievement, career direction, and communication skills. A repeated theme in all of these areas, self-confidence seemed to be particularly powerful for those individuals who described themselves as shy when they entered the program.

- Problem-Solving – Participants had developed a number of strategies and approaches for creative problem solving that they continue to apply in a number of settings, many of which evolved from communication strategies learned as an Explainer.

- Interpersonal – While this was not specifically a skill set we sought to investigate, the lasting impact of developing the ability to regulate emotions, exhibit patience, and handle difficult situations and people was notably useful for participants throughout life.

- Leadership – Particularly for participants who climbed to the higher rungs of the Career Ladder, the experiences of learning how to supervise and manage staff led to future ability to be a strong leader.

Science Literacy and Engagement

The program also successfully impacted the lifelong learning habits and attitudes toward science of its former participants. Program alumni claim became lifelong learners of science. They claim to continue to engage in some science-related activities on a regular basis, including reading science articles, watching science television, and visiting informal science settings. Alumni reported that the program also helped them to develop an ongoing curiosity that characterizes their approach to life.

The program appears to be very successful at helping participants develop positive attitudes toward science. The alumni generally consider science as an integral and relevant part of their lives. These attitudes manifest in different ways for individuals, and include:

- Those who enter the program with a dislike of science generally change their attitudes. Their experiences with the program and the museum lead many of them to appreciate, respect, and enjoy science. The program helps them to develop a new understanding of how science is relevant to them and to appreciate their abilities as a science learner.

- Many participants acquire an awareness of the science that surrounds them in daily life. They report frequently drawing on their experiences in the program in order to see the science behind everyday occurrences and facts.

- For those who entered the program with the plan to pursue a career in science, the program seemed to reinforce that commitment. It also helped some to understand the value of outreach as part of a science career and a desire to share science information and enthusiasm with a public audience.

Program Design

The program appears to be designed to support the growth and development of its participants in a number of ways that particularly resonate with former participants. While the paid job motivates people to join the program, the factors that motivate retention and job satisfaction change and come to include an enjoyment of the science, satisfaction with teaching, the comfortable environment, and the flexible schedule.

The program also appears to be successful as a career ladder. A majority of those leaving the program do so to pursue other jobs, careers, or higher education. If one views the Science Career Ladder as a program for professional growth that promotes its staff not only within the NYHOS but prepares them for future endeavors, all of the outcomes identified in this study are positive indicators. These results indicate that newer participants may have greater struggles with balancing time and schedules, whereas those who have been involved in the program the longest may be more concerned about a need for a higher salary or new job opportunities.

The program's design generally builds participants' self-confidence, particularly through the focus on training, peer-to-peer teaching, and relatable peer-aged supervisors. These factors were cited as contributing factors to why participants describe the SCL Program as supportive and encouraging, with co-workers and supervisors all forming a strong social network.

Considering the responses of program alumni to all of these impact areas, an overarching theme to emerge is the ability of the program to provide for the personal and professional development of individuals in a way that responds to each person's strengths, weaknesses, and needs. The supportive environment fostered by the program's staff, the variety of skills needed in the course of an Explainer's responsibilities, and the emphasis on training and encouragement in the program's structure seem to create a dynamic environment in which participants can develop skills that will help them achieve their greatest potential. This program flexibility, its inquiry-based learning experiences, and its supportive community network, all appear to be important elements to maintain for the Science Career Ladder Program.

REFERENCES

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Storksdieck, M., Haley Goldman, K. & Cohen Jones, M. (2002). *Impact of the New York Hall of Science Career Ladder Program on its former participants*. Technical report. Annapolis, MD: Institute for Learning Innovation.

New York Hall of Science Explainer Alumni Survey

Thank you for participating in the Explainer Alumni survey! On the following screens you will answer a series of questions about your interests, what you've been doing since leaving the Explainer Program, and your thoughts about your experience as an Explainer. We would like to get your honest feedback about the program. The questionnaire should take about 15 minutes to complete.

We appreciate your time and feedback about the program. If you have any questions about this survey, please contact Jenny Correa (jcorrea@nyscience.org). Thank you!

___

1) We have some questions about your spare-time activities. How often (if at all) do you do the following things? (Please give a rough estimate)

	Never	Rarely (once a year or less)	Occasionally (several times a year)	Frequently (every one or two months)	Very Frequently (at least once a week)
...read a science-related book?	○	○	○	○	○
...read science-related articles in newspapers, magazines, websites, blogs, or journals?	○	○	○	○	○
...go to public lectures on science-related topics?	○	○	○	○	○
...listen to radio shows or podcasts about science?	○	○	○	○	○
...watch documentaries or TV shows about science?	○	○	○	○	○
...visit science museums, planetariums, zoos, etc.?	○	○	○	○	○
...talk to family or friends about science-related issues?	○	○	○	○	○

2) What are you doing now? (check all that apply)
- ❑ High School
- ❑ Trade/Vocational School
- ❑ Community College
- ❑ College/University (as an undergraduate)
- ❑ Graduate School
- ❑ Working full-time
- ❑ Working part-time
- ❑ Military Service
- ❑ Between jobs
- ❑ Stay-at-home parent
- ❑ Other (please specify)

If you selected other, please specify

_____

3) What is your current major(s) or program of study? If you are undecided, type "undecided" below

_____

4) Do you have plans to pursue further education?
- ○ Yes
- ○ No
- ○ Not sure

5) If yes, what are those plans?

_____

6) What would you like to be doing as a career 10 years from now?

_____

7) What is your current occupation?

_____

Tell us a little bit about your occupation:

8) Is your occupation…

	Yes	No
…in a field of science, technology, engineering, or mathematics?	○	○
…as a classroom teacher?	○	○
…in an informal learning setting (like a museum, science center, zoo)?	○	○

9) Does your occupation…

	Never	Rarely	Occasionally	Frequently	Very Frequently
…require you to use teaching skills (such as instructing, coaching, mentoring)?	○	○	○	○	○
…require you to use communication skills?	○	○	○	○	○
…require you to use scientific skills (such as data collection, data analysis, or drawing conclusions from data)?	○	○	○	○	○
…involve science in regular work activities?	○	○	○	○	○

10) In what setting do you teach?
- ❑ Pre-School
- ❑ K-12 Classroom
- ❑ Higher Education (college) / Continuing Adult Education
- ❑ Other (please specify)

If you selected other, please specify

_____

11) Are you currently a classroom <u>science</u> teacher?
- ○ Yes
- ○ No

12) How much do you feel that being in the Explainer program influenced your career decisions?
- ❍ Not at all
- ❍ Very little
- ❍ Somewhat
- ❍ Strongly

13) Please explain how being in the Explainer program did or did not influence your career decisions:

_____

14) What is the highest level of schooling that you have <u>completed</u>?
- ❍ High School Diploma
- ❍ Trade/Vocational School or Certification
- ❍ Associate's Degree (AA, AS, etc.)
- ❍ Bachelor's Degree (BS, BA, etc.)
- ❍ Master's Degree (MS, MA, etc.)
- ❍ Doctoral Degree (PhD, MD, JD, etc.)
- ❍ None of the above

15) Think back to when you started as an Explainer. Back then, what level of schooling did you think you were going to complete?
- ❍ High School Diploma
- ❍ Trade/Vocational School or Certification
- ❍ Associate's Degree (AA, AS, etc.)
- ❍ Bachelor's Degree (BS, BA, etc.)
- ❍ Master's Degree (MS, MA, etc.)
- ❍ Doctoral Degree (PhD, MD, JD, etc.)
- ❍ I wasn't sure
- ❍ None of the above

16) How much do you feel that being in the Explainer program influenced your academic decisions?
- ❍ Not at all
- ❍ Very little
- ❍ Somewhat
- ❍ Strongly

17) Please explain how being in the Explainer program did or did not influence your academic decisions:

_____

18) What was your undergraduate, associates, or vocational school degree in?

_____

19) When you <u>started</u> college or vocational school, what was your major(s)? If you were undecided, type "undecided" below.

_____

20) What was your Master's degree in?

_____

21) What was your Doctoral degree in?

_____

For the next few sets of questions, we'd like you to think about yourself before you were an Explainer and after you were an Explainer.

Think about how your feelings, attitudes, or abilities changed as a result of being in the Explainer program.

22) How much (if at all) did being an Explainer help you improve your…

	No improvement	Very little improvement	Some improvement	Much improvement	A great deal of improvement
…confidence in talking to new people?	❍	❍	❍	❍	❍
…confidence as a student/learner?	❍	❍	❍	❍	❍
…confidence in your ability to teach others?	❍	❍	❍	❍	❍
…confidence in talking about science?	❍	❍	❍	❍	❍
…confidence in your ability to succeed in life?	❍	❍	❍	❍	❍
…your self-confidence overall?	❍	❍	❍	❍	❍

23) Comments (optional):

_____

24) How much (if at all) did being an Explainer help you improve your ability to…

	No improvement	Little improvement	Some improvement	Much improvement	A great deal of improvement
…ask critical questions?	❍	❍	❍	❍	❍
…think creatively?	❍	❍	❍	❍	❍
…analyze a problem and find solutions?	❍	❍	❍	❍	❍
…interact with people?	❍	❍	❍	❍	❍
…communicate ideas effectively?	❍	❍	❍	❍	❍

25) Comments (optional):

_____

26) After being an Explainer, did you do the following things more often, less often, or did it stay the same?

	Much less often	A little less often	About the same	A little more often	Much more often
...have conversations about science topics or events?	❍	❍	❍	❍	❍
...notice science in everyday life?	❍	❍	❍	❍	❍

27) Comments (optional):
_____

28) After being an Explainer, did you have more, less, or about the same interest in the following things?

	Much less interested	A little less interested	About the same	A little more interested	Much more interested
...reading/watching science stories on news, TV, radio, the Internet, etc.?	❍	❍	❍	❍	❍
...visiting museums?	❍	❍	❍	❍	❍
...sharing what I know with others?	❍	❍	❍	❍	❍
...science?	❍	❍	❍	❍	❍
...teaching?	❍	❍	❍	❍	❍
...going further in my education?	❍	❍	❍	❍	❍
...thinking about science topics and issues?	❍	❍	❍	❍	❍

29) Comments (optional):
_____

30) In your life now, do you still use what you gained or learned from the experiences you had as an Explainer?
- ❍ Not at all
- ❍ Very little
- ❍ Somewhat
- ❍ Very much

31) Please explain:
_____

32) What aspects of the Explainer Program led you to apply originally? (check all that apply)
- ❑ I needed/wanted a paying job
- ❑ Someone told/encouraged me to apply
- ❑ It was just something to do
- ❑ It was better than other jobs I could have taken
- ❑ I liked science
- ❑ I liked teaching
- ❑ To be with friends or to meet new people
- ❑ It sounded like fun
- ❑ It had a flexible schedule
- ❑ I knew someone who worked there
- ❑ Other (please specify)

33) Which one aspect was MOST important in deciding to apply? (choose only one)
- ❍ I needed/wanted a paying job
- ❍ Someone told/encouraged me to apply
- ❍ It was just something to do
- ❍ It was better than other jobs I could have taken
- ❍ I liked science
- ❍ I liked teaching
- ❍ To be with friends or to meet new people
- ❍ It sounded like fun
- ❍ It had a flexible schedule
- ❍ I knew someone who worked there
- ❍ Other (please specify)

If you selected other, please specify
_____

34) What aspects of the Explainer program motivated you to continue working there? (check all that apply)
- ❑ The paycheck
- ❑ It was something to do
- ❑ It was better than other jobs I could have been doing
- ❑ I liked learning/doing science
- ❑ I liked teaching
- ❑ Being with my friends / people I worked with
- ❑ It was fun
- ❑ The flexible schedule
- ❑ It felt comfortable to work there
- ❑ There was a chance for me to advance in the job
- ❑ My supervisor(s) were nice to work for
- ❑ Other (please specify)

If you selected other, please specify
_____

35) Which one aspect was MOST important in motivating you to continue working there? (choose only one)
- ❍ The paycheck
- ❍ It was something to do
- ❍ It was better than other jobs I could have been doing
- ❍ I liked learning/doing science
- ❍ I liked teaching
- ❍ Being with my friends / people I worked with
- ❍ It was fun
- ❍ The flexible schedule
- ❍ It felt comfortable to work there
- ❍ There was a chance for me to advance in the job
- ❍ My supervisor(s) were nice to work for
- ❍ Other (please specify)

If you selected other, please specify
_____

36) Which one factor was MOST important in you deciding to leave the Explainer program? (choose only one)
  - ❍ Needed higher pay
  - ❍ I got bored with the job
  - ❍ For a better job opportunity
  - ❍ I was going away to college
  - ❍ I was moving out of the area
  - ❍ I didn't like all the science
  - ❍ I didn't like teaching / interacting with the public
  - ❍ I didn't get along with the other Explainers
  - ❍ It wasn't fun
  - ❍ It was too hard to balance the Explainer job and other commitments (like school)
  - ❍ I felt like there was no room for me to advance or grow
  - ❍ I didn't get along with my supervisor(s) or leadership
  - ❍ Other (please specify)

If you selected other, please specify
_____

37) What year did you join the Explainer program? If you cannot remember exactly, give us your best guess.
  - ❍ 1986
  - ❍ 1987
  - ❍ 1988
  - ❍ 1989
  - ❍ 1990
  - ❍ 1991
  - ❍ 1992
  - ❍ 1993
  - ❍ 1994
  - ❍ 1995
  - ❍ 1996
  - ❍ 1997
  - ❍ 1998
  - ❍ 1999
  - ❍ 2000
  - ❍ 2001
  - ❍ 2002
  - ❍ 2003
  - ❍ 2004
  - ❍ 2005
  - ❍ 2006
  - ❍ 2007
  - ❍ 2008

38) In what capacity did you <u>join</u> the Explainer Program?
- ❍ Explainer Volunteer
- ❍ Explainer Intern
- ❍ Explainer (while in high school)
- ❍ Explainer (while in college)

39) <u>When you first joined</u> the Explainer Program, what grade were you in? (If you joined in the summer, which grade had you just completed?)
- ❍ 9th
- ❍ 10th
- ❍ 11th
- ❍ 12th
- ❍ college freshman
- ❍ college sophomore
- ❍ college junior
- ❍ college senior
- ❍ graduate school

40) Which positions did you hold during your time at the New York Hall of Science? (check all that apply)
- ❑ Explainer Volunteer / Public Program Volunteer
- ❑ Explainer Intern / Public Programs Assistant
- ❑ Explainer
- ❑ Program Explainer
- ❑ Senior Explainer
- ❑ Other (please specify)

If you selected other, please specify

_____

41) How long did you stay active in the Explainer Program?
- ❍ less than 6 months
- ❍ 6 months – less than 2 years
- ❍ 2 years – less than 4 years
- ❍ 4 years or more
- ❍ Other (please specify)

If you selected other, please specify

_____

42) Did you have any siblings or relatives in the Explainer program <u>before</u> you joined?
- ❍ Yes
- ❍ No

43) What is the highest level of schooling completed <u>by one or both of your parents</u>?
- ❍ Some High School
- ❍ High School Diploma
- ❍ Trade/Vocational School
- ❍ Associate's Degree (AA, AS, etc.)
- ❍ Bachelor's Degree (BS, BA, etc.)
- ❍ Master's Degree (MS, MA, etc.)
- ❍ Doctoral Degree (PhD, MD, JD, etc.)
- ❍ None of the above

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New York Hall of Science
Science Career Ladder Retrospective Study
August 2009

44) Do/did your parent(s) have jobs in any of the following fields? (check all that apply)
- ❑ Science
- ❑ Technology
- ❑ Engineering
- ❑ Math
- ❑ Teaching
- ❑ None of these

45) Are you...
- ❍ female
- ❍ male

46) In what year were you born?

Year (yyyy):_____

47) Race/Ethnicity: (check all that apply)
- ❑ White
- ❑ Black / African American
- ❑ Mexican, Mexican American, Chicano
- ❑ Puerto Rican
- ❑ Cuban
- ❑ Other Spanish / Hispanic / Latino ethnicity
- ❑ West Indian
- ❑ American Indian or Alaska Native
- ❑ Asian Indian
- ❑ Chinese
- ❑ Filipino
- ❑ Japanese
- ❑ Korean
- ❑ Vietnamese
- ❑ Native Hawaiian
- ❑ Other Pacific Islander
- ❑ Other (please specify)_____

48) Do you have any additional comments to share with us?_____

49) We would like to talk to some Explainer Alumni further about their experiences with the program. It would be just a brief telephone conversation in late February or March. Would you be willing to be contacted for a brief follow-up conversation about the Explainer Program?
- ❍ Yes   ❍ No

50) Thank you! Please supply us with an e-mail address or phone number so that we can contact you to arrange a convenient time to talk with you further. Be assured we will *only* contact you about this survey and will not use your personal information for any other reason.

e-mail address and/or phone number:_____

Thank you very much for completing this survey!

The Explainer Program would like to keep our alumni records up to date. If you would like to update your information in our database, please type your contact information below and check the "yes" box at

the bottom of the screen. This information will only be used for the purposes of updating our records and <u>will not </u>be associated with your survey responses. If you do not wish to update your information, just select no and click the "Next Page" button at the bottom of this screen.

51) Update my contact information:

Name   _____

e-mail address   _____

Phone number   _____

Mailing address   _____

City   _____

State   _____

Zip Code   _____

52) May the Explainer Program staff use the information above to update your contact information in our database?

❍ Yes, update my information.

❍ No, do not update my information.

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New York Hall of Science
Science Career Ladder Retrospective Study
August 2009

Survey Invitation: Postcard Text

Complete a short survey and enter to win a $50 gift card!

Dear NYHOS Explainer Alumnus,

We need your help! We are conducting a survey of past Explainers to find out what all of you are up to now, your interests, and what you think about the Explainer Program. We want to hear from as many former Explainers as possible, since you are the experts on our program.

What do you need to do? **Go to the website: www.nyscience.org/SCL_Survey.** Answer the questions (it'll take about 10-15 minutes). That's it!

To thank you, we're offering four $50 Gift Cards to Amazon.com. In March, we'll draw four names at random from those who complete the survey, and each will receive a $50 gift card! Your answers are crucial to help us improve the Science Career Ladder program. We look forward to hearing your opinions. **Please fill out this survey by February 28** to be entered in the drawing!

Thank you so much for all your help!
Preeti Gupta and Jenny Correa

P.S. Give us a call if you have any questions! (718-699-0005 ext. 345)

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Science Career Ladder Retrospective Study
August 2009

Survey Invitation: Email Text

Subject: Your Opinions about the NY Hall of Science Explainer Program

Dear NYHoS Explainer Alumnus,

We need your help!

We are conducting a survey of past Explainers to find out what all of you are up to now, your interests, and what you think about the Explainer Program. We want to hear from as many former Explainers as possible, since you are the experts on our program.

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To thank you, we're offering four $50 Gift Cards to Amazon.com. In March, we'll draw four names at random from those who complete the survey, and each will receive a $50 gift card! Your answers are crucial to help us improve the Science Career Ladder program. We look forward to hearing your opinions. **Please fill out this survey by February 28** to be entered in the drawing!

We apologize if you get this message more than once (we're also sending a post card in the mail telling people about the survey). You only need to complete the survey one time.

Thank you so much for all your help!

Preeti Gupta and Jenny Correa

P.S. Give us a call if you have any questions! (718-699-0005 ext. 345)

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Telephone Interview Guide

Introduction
Hello, my name is _____, from _____and I'm calling about the Explainer Program at the NY Hall of Science. Thanks for agreeing to speak with me. Is now a good time for you to talk?

[if asked] The interview will take no more than 15 minutes; it's very quick.

As you know, we're talking to alumni of the Explainer Program to help us better understand the experiences and opinions of those who completed the program. I'd like to ask you some questions that follow-up on the responses you gave to our on-line survey.

I would like to assure you that all of your responses will remain anonymous. I'm the only person who will know your name and contact information, and I will remove them from all materials I have in front of me as soon as we're done. Your name will not be attached to any of our reports or analysis. We want your honest experience and feedback about the program. I will be typing your responses while we speak.

May we continue with the interview?
[Wait for an affirmative response and note the time on the interview sheet]

Survey ID: _____   Date: _____   Time: _____

Science Literacy and Engagement

1. What is the first thing that comes to mind when you think about science?

2. In general, would you say you are curious about science or science-related topics?
Probe → In what ways?

3. Do you think that your experience with the Explainer Program influenced your ways of thinking about science at all?
Probe for YES → In what ways did it influence you?

Probe for NO → What other things in your life had a greater influence on your ways of thinking about science than the Explainer Program?

Skills, Abilities, and Behaviors

4. In the survey, you indicated that you still draw upon the experiences you had in the Explainer program _____. In what ways do you think it has the most influence on your daily life now?

For Q5 and 6 – We asked about the program's impact on 5 skills:

...ask critical questions?   *...interact with people*

...think creatively?   *...communicate ideas effectively*

...analyze a problem and find solutions?

Select one of the skills where they indicated some improvement on in the survey. Use that for Q5. Use a different skill for Q6.

5. In the survey, we asked about how the Explainer Program helped improve your abilities to _____, and you indicated that your skills improved _____. What was it about the program that helped you improve your abilities in this area?

Probe → Can you describe how those abilities improved?

6. In the survey, we asked about how the Explainer Program helped improve your abilities to _____, and you indicated that your skills improved _____. What was it about the program that helped you improve your abilities in this area?

Probe → Can you describe how those abilities improved?

7. In the survey, you indicated that the Explainer Program helped improve your self-confidence____. What was it about the program that helped improve your self-confidence?

Probe → Were there any areas of self-confidence that were particularly improved?

Academic Achievement

8. You indicated that the program had _____ influence on your academic decisions.

If it had influence → **How did the program influence your decisions about school?**
[possible areas for exploration - how far to go, what to study, where to study, what not to study, where not to go]

If it did not have influence, or weak influence → **What types of things had greater influence on your academic decisions?**

9. Do you think that the program helped you develop any skills that were useful to you academically?

What skills were those?

Career/Professional Development

Of those who indicated they work in the sciences
10a. You indicated that you are now a _____ and that you work in the sciences. In what ways did the Explainer program influence this career choice, if at all?

Probe →Were you interested in a science career before you became an Explainer?

Of those who indicated that they are teachers
10b. You indicated that you are now a classroom teacher, is that correct? Did the Explainer program have any influence on this career choice?

In what ways did it influence this choice?
Probe → Were you interested in becoming a teacher before you became an Explainer?

Of those who are neither
10 c. What influence did the Explainer program have on your career choice, if any?

Probe for None or Minimal → Can you tell me what types of experiences had more influence on your career choice?

Of those who are still in school
10 d. How do you think the Explainer program has influenced your career goals or direction?
Probe for NO or Minimal → What experiences or factors other than the Explainer Program have influenced your career goals or direction?

Program Design

11. I'd like you to think back to when you were in the Explainer Program. What was it about the program – the way it was structured, the things you did, anything – that you found most beneficial personally?

→ On the flip side, was there anything you would change about the program? [Why would you change that? – getting at why it was non-beneficial]

➔ Did anything about the program ever make you feel intimidated? [What was it and how did it intimidate; Was it something they eventually got over (e.g., learned the demo and it wasn't intimidating anymore]

12. In the survey, you indicated that _____ was the thing that most motivated you to continue being an Explainer. Can you tell me more about why that was?

Probe → How did your motivations for being an Explainer change over time?

13. We've heard from many people that there is a strong social component to the Explainer Program; Explainers spend a lot of time with one another. I'd like to talk more about that. How did getting to know, spending time with, or interacting with the other Explainers influence your experience?

Probe → Did these social experiences have an influence on your career choice or academic direction?