



Smithsonian Institution

NATIONAL
MUSEUM *of*
NATURAL
HISTORY



CENTER FOR RESEARCH
AND EVALUATION

Lifelong Learning Group

**National Museum of Natural History:
YES! At 10: A Retrospective Impact Study
Executive Summary**

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Executive Summary

With funding from the Smithsonian Institution's Youth Access Grants program, the National Museum of Natural History established Science Career Access and Learning Experiences (SCALE) to impact the lives of Washington D.C. teens who otherwise have had limited access to high quality authentic science experiences. SCALE programming involves a pipeline of community collaboration outreach and science events feeding robust out-of-school program offerings, volunteer opportunities, and ultimately, paid internships. These internships have been offered by the museum's YES! (Youth Engagement through Science) program, and more recently the Q?Crew Captains program. In 2019, the museum added to the pipeline continued engagement through an Alumni Ambassador program. This expansion utilized the 10th anniversary of its YES! (Youth Engagement through Science) internship program as a vehicle for expanding internships to include YES! alumni who multi-functioned as near-peer mentors; liaisons for building a strong alumni network; and data collectors for this study of longer-term YES! impact.

The COSI Center for Research and Evaluation (Franklin County Historical Society dba COSI CRE) has conducted evaluations of NMNH Youth Programming over the past three years, including an evaluation in 2018 of the SCALE Pipeline. In 2019, NMNH requested that COSI CRE design and work with Alumni Ambassador Interns to conduct the long-term YES! at 10 impact study.

COSI CRE is a research and evaluation team focused on collaborative study of how people learn across the lifespan, in informal settings, and at the intersection of school and out-of-school learning. Deborah Wasserman, Ph.D., this project's director, has experience evaluating programs involving informal learning and youth development and specifically with understanding these programs through a self-determination theory-based perspective (Wasserman, 2010). She has functioned as evaluator for the NMNH YES! program since 2015. Moira Ragan, CRE research assistant, is a program evaluation Ph.D. candidate at Ohio University, has brought to this project expertise in survey design and data analysis. Laura Blanton, Q?rius Educator, and Anna Jaysing, Dumbarton Oaks Humanities Fellow, have led the effort to code all qualitative questionnaire data and conduct and code all follow-up interviews. Their expertise was integral to identifying emergent themes and creating the coding structure.

Intended outcomes. To date COSI CRE's YES! evaluations have focused on five intended program outcomes; (1) instill specific science-related content or skill; (2) promote and affect interest in and motivation for studying science and science careers; (3) enhance skill and confidence with communicating about science; (4) enhance 21st century skills (including communication; critical thinking; creativity; leadership; identity, and social and emotional literacy); and (5) creating both professional and peer support networks. This retrospective study investigated the program's longer contribution to each of these outcomes.

Research Questions

This retrospective study sought to more thoroughly learn how YES! programming has impacted the lives of youth interns, most of whom were selected into the program because they came from groups under-represented (e.g. female; minority) in the sciences. Moreover, because of its more thorough approach, its intention was to produce important information and direction for creating a functioning and valuable Alumni Ambassador's program. Thus, the study will seek to answer the following questions:

1. To what extent did the YES! high school internship contribute to the intended program outcomes? (as listed in the introduction above:).
2. To what additional (e.g., lifestyle, parenting, etc.) longer-term outcomes did the YES! internships contribute?
3. What program strategies affected the level and type of program impact?
4. Envisioning a vibrant Alumni Ambassadors program. How can NMNH best establish an Alumni Ambassadors Network that will mutually benefit alumni and NMNH youth programming? Sub-questions include: In what ways are Alumni interested in staying involved with each other and NMNH? What benefits might they derive from continued involvement? How might ongoing alumni or cohort connection serve them? In what ways might they be interested in contributing to current YES! interns' current or ongoing experiences? [e.g. in which of the following activities would you participate? What additional ideas do you have?]


Method: a sequential mixed method exploratory-explanatory design

To answer these evaluation questions this study utilized a sequential mixed method exploratory-explanatory design (Creswell & Creswell, 2018) with data coming primarily from online questionnaires completed by YES! alums contacted by peers hired as interns during the summer of 2019. The overall strategy involved completing online questionnaires followed by follow-up interviews of alums selected for the need for explanation of the most informative questionnaire responses. As detailed below, COSI CRE worked collaboratively with NMNH Youth Programs staff, a project research fellow, and alumni interns, some of whom functioned in role of research assistants.


Results- Q1. How the Programs Contributed to Intended Outcomes


In this section we mark conclusions with a  to indicate a success and  to indicate findings that may require closer review or attention.


Outcome 1. Content and Skill

 YES! has exceeded its goal of instilling specific science related content and skill. Alums wrote and spoke of specific science content; science skills that included research, science communication, and lab skills. Equally important, alums acquired academic, workplace and personal development skills. These included communication, self knowledge, and academic knowledge and skills that included college selection, entrance, and academic learning.


Outcome 2. Science Identity, Interest, Study, and Careers


 The YES! program contributed to respondent's science identity with a lasting effect over time. Almost all (90%) reported a greater integration with science now than before entering the program. Greatest integration was in the areas of interest in the way science can be used to solve problems and how science can be used to help people. Respondents attributed this science interest somewhere between "moderately" and "a lot" to YES!, with most program contribution attributed to their persistent interest in communicating about science.


 There was also evidence that on the average across all interns including non-respondents, science identity improved.

 Nearly all responding YES! alums attributed to their YES! internships at least a moderate amount of influence on their choice of college major and/or minor (84%). Of that group, almost half majored in a natural science, one third in a social science and the rest in technology, engineering or math. In some cases YES! influenced even going to college at all.

The YES! program helped me see college as more of an option for myself so I became more ambitious in my pursuit of college acceptance to 'bigger and better' colleges."

 Almost three quarters of respondents had chosen STEM-based career paths. Of this group almost 80% reported at least a moderate YES! effect on their choice.

 However, by cohort, the number of respondents pursuing STEM ranged from 87% in the youngest cohort to only 45% in the oldest (among whom 68% had graduated from college with another 19% either attending or planning to return).

 For many interns, YES! created broad exposure to and deeper understanding of science, science disciplines, and science career options. These experiences led to conceptual and attitudinal shifts that helped interns find clarity about academic and career direction or gain more general career awareness and interest. This exposure and understanding emerged from personal

relationship to professionals including project mentors; having science educators as role models; the quality of relationships with staff and mentors; having direct workplace experience; and specific YES! program activities such as field trips, lectures, and working with the public.

I conducted a small study during my time at the Zoo. Those experiences prepared me for the greater research I've completed in private companies and other universities since being in college.

👍 Of the responders in the oldest cohort (7 to 9 years post high school graduation), 91% had selected a science major; 68% had graduated from college and 45% were pursuing a STEM career at the time of the survey. Across the whole YES! alum population, even if every non-responder had left college before graduating, half of the cohort group would have pursued a STEM major, a third would have graduated, and a quarter would be pursuing a stem career. These numbers compare quite favorably to those of the general population “leaky pipeline” study that showed that of all college ready seniors, one fifth chose stem majors and just over a tenth graduated from college (National Science Board, 2008).

For the YES! alums, who participated in this study (60% of the alum population), YES! experiences led to conceptual and attitudinal shifts that helped interns find clarity about academic and career direction or gain more general career awareness and interest.

Outcome 3. Science Communication

👍 Just over half of the responding Alums valued their YES! experience for having contributed to their ability to utilize good science communication skills. On the average, respondents rated as moderate both their communication skill use and YES! contribution to their ability to use those skills. Half of the respondents were, on the average, using the skills at least moderately and also, at least moderately attributed to YES! their ability to do so.


👍 Alums used these skills academically, in the workplace, and outside of work or school. At school, they used them to communicate research and disseminate information.


👍 In work settings they used their YES! communication skills for public speaking, explaining ideas, thoughts, and opinions, translating science concepts to those in other fields, formal presentations, scientific writing,

👍 Outside of work, they described using their skills for climate change advocacy, career access to under-represented groups and for modulating explanations to be sensitive to the needs of differing audiences.

Outcome 4. 21st century skills


There's no way that I can talk about being passionate for science without talking about YES!, without talking about those two summers that I spent there at the museum; learning and building friendships, and just networking with scientists, talking to them on a first name basis.... I think those are really big things. When those barriers, those imaginary barriers that we have growing up, are really just deconstructed and just destroyed--YES! really destroyed those barriers for me. Yeah, you can really, really do anything. And I don't think that my experience is that unique. I think that if you talk to anybody who did YES!, I think that the same things will arise. YES! just really taught you how to be great.

 On the average, older alums credited YES! with contributing more than “a lot” to their leadership skills and sense of environmental stewardship.

 Alums from the most recent cohorts attributed these attributes just less than “a lot” to YES!



Recommendation: This finding suggests that program administrators will benefit from further exploring the reason for this difference and if necessary make program changes, perhaps even return to some earlier strategies, that promote leadership.

 Alums wrote and spoke of the breadth and depth of skills gained that will better serve them functioning in today’s world. Based upon the structure of 21st century skills, those most frequently represented by alums are communication & collaboration, initiative & self- direction, and critical thinking skills. Alums somewhat mentioned gaining leadership and social literacy skills, however these instances were not as frequent as the previously mentioned skills. As a whole, the responses illustrate that these skills frequently co-occur with other skills and that interns experienced a sense of breadth and depth of these broader skills categories.



Recommendation: This finding suggests that program administrators will benefit from further exploring the reason for this difference and if necessary making program changes, perhaps even return to some earlier strategies, that promote leadership.

Outcome 5. Networking


I have learned that there are people out there who are willing to help you achieve your dreams. I have learned to reach out, be open to new adventures/challenges, and asked for help. – a questionnaire respondent


Many YES! alums left the program understanding the power of networking. Two success story interviews involved utilizing the YES! network itself – one to utilize cohort colleagues as exhibit explainers at a science festival; another to use both colleagues and mentors to further the efforts of starting and fulfilling the purpose of not-for-profit organization that assists and encourages young


women to enter the sciences. Despite these two stories there were few other examples of within cohort networking.

Written references to networking described it as a well-appreciated skill acquired through YES! and applied academically, in careers, and beyond school and work. Academically, alums used networking skills to connect with teachers, mentors, and professionals. They also wrote about valuing their networking skills to get job interviews and valuing networking knowledge as a marketable job skill in and of itself. Some alums wrote about using networking skills outside of school and work some to locate and connect socially or politically with others with similar science interests.

Results – Q2. How the Program Contributed to Unintended Outcomes

 Outside of school or work, more than two thirds of the responding YES! Alums engaged in at least one type of STEM-related activity. Most frequently the activities involved hobbies or volunteering, and slightly less so, for political activism.

 Across each of the activity types, most all participants in that activity reported a moderate to high contribution of their YES! experience.

 However, overall, less than half of all the respondents reported a moderate to high YES! influence on their participation in any one activity.

I am still very passionate about science. I volunteer with Bernie Sanders and his plan to combat climate change, a topic I learned a lot about at the NMNH. A lot of my artwork is about natural science. I like to learn about the subjects of my paintings which are usually plants, animals and people.

Outside of school or work, more than two thirds of the responding YES! Alums engaged in at least one type of STEM-related activity. Most frequently the activities involved hobbies or volunteering, and slightly less so, for political activism.

Across each of the activity types, most all participants in that activity reported a moderate to high contribution of their YES! experience. However, overall, less than half of all the respondents reported a moderate to high YES! influence on their participation in any one activity.

Beyond the YES! intended outcomes, YES! alum experienced outcomes that could be categorized as involving awareness; conceptual/attitudinal shifts; interests or involvement; personal development; NMNH/Smithsonian involvement; personal development; or what can be considered “stepping stone,” i.e., indirect contribution to an outcome achieved in a different experience. Respondents often ascribed these outcomes to the program, the people in the program, to conceptual shifts in thinking or understanding, or to the project in general.

The program made me more comfortable with small talk and public speaking, so I gained confidence in my ability to move in circles that I wouldn't necessarily "fit" in.

The most frequent beyond-intended outcomes involved YES! program activities and involvement with some beyond-intended outcome, for example, *The sample collecting hikes made me fall in love with nature.*







Alums engaged in many types of YES! inspired involvement. The most common types were educating others, volunteering, and engaging in extra-curricular activities. Awareness included heightened awareness pertaining to modern applications of science, science related issues,

Frequently occurring beyond-intended outcomes included transferrable skills (e.g., science to art), an awareness of or interest in combatting barriers to STEM accessibility, and finally alum development of a stepping stone experience.

Even though I don't currently plan on working in the field of science I have learned professional skills and how to communicate that will help me in my field of Law.

I decided I would want to explore forever and explore ways to better lives (not exactly through natural science) but using my interests in psychology and research to eliminate workplace abuse and toxicity.

Results - Q3. Program Strategies Affecting Program Impact

-  Of all the program strategies, study participants rated mentoring as contributing most to their learning.
-  YES! alums described themselves as learning across five categories: learning specific skills or content; learning about their personal academic or career direction; learning from exposure to broad ranges of opportunity, learning through forming social relationships; and learning through finding value in sharing learning with others and helping them learn.
-  Key program components—mentors, peer interns, and staff—contribute to the broadest range of these learning categories.
-  Tour field trips also provided equally broad contribution, perhaps suggesting that an equally key aspect of YES! is its location at the Smithsonian and its relationship to the broad range of Smithsonian scientists, research, and museologists, and educators.
-  Program strategies such as Community Day, Intern is In, TED Talks, and Science Communication Training were particularly important to building knowledge and skills. Some were particularly noted for their value in providing opportunity to share that learning with others.
-  Additional strategies emerged as important to the program. These included opportunities to talk with scientists; the value of the research project and working in a lab; the importance of peer interaction, and diversity within the cohort and staff.

Results - Q4. Establishing an Alumni Ambassador Network

Participant responses showed good reason to believe an alumni network have plenty of interested members and would fill an important need. Only two respondents said they would have no interest in staying in touch while more than a third reported no longer being in contact with any YES! colleagues. Most wanted to maintain contacts for the purpose of staying in touch with friends, followed by maintaining a network for career advancement and generally to satisfy curiosity about what colleagues are doing (each were reasons for about a third of the respondents).

Only half of the responding alums would choose to stay in touch with YES! staff. Their reasons were to maintain a network for career advancement (34%) and to maintain friendships (25%)

Most of the responding alums also said they were interested in providing support to current YES! interns' applications and planning for college. Just over half were interested in sharing lessons learned from their own YES! experience and in attending YES! presentation events.

Respondent suggestions for maintaining an alum network involved strategies for fostering community and communication.

Conclusion

This YES! at 10 retrospective evaluation sought to answer four evaluation questions. To answer them, nine interns, a research fellow, and an NMNH educator worked with the COSI Center for Research and Evaluation to answer them. Together, the nine interns, one from each of the YES! cohorts located and recruited into the study a total of 102 YES! alums, 60% of the total YES! alum population. After completing a questionnaire that included, in addition to quantitative measures that have been used to evaluate the program over the past three years, 13 open-ended questions, thirteen alums were selected for best-case scenario interviews. Success case selection provided a means for seeing how well the program could succeed in order to set goals for making these success cases the norm. After collecting the data via online surveys, the interns developed coding schemes for each of the questions. The NMNH educator and NMNH research fellow then refined the codes, conducted analyses and contributed substantially to writing this report.

The YES! internship program intention was to open science, academic, and professional doors to young people from population groups typically under-represented in the science professions. Over ten years, YES! contributed at least moderately, to the current science status of an estimated 80% of its 177 total participants. This status included choice of academic major; career choice; science identity; science interest; and leadership skills. For a portion of this group, an estimated 27% of all participants, YES! contributed highly, having provided an impactful and lasting experience. This report has captured the range and types of these impacts with stories from 13 of the 48 alums in this group.

For just over half of YES! participants, the internship contributed moderately, often functioning as a stepping stone to other equally or even more influential STEM opportunities. Where possible, this report has documented those “stepping stone” experiences.

It was beyond the scope of this project, but further analysis could be conducted to separately understand the experiences of the moderate and low YES! contribution groups, even asking very specific questions. For example, to better understand the “pipeline” experience of the YES! lower impact group, a researcher could analyze both quantitative and qualitative responses from a 1st cohort (2010-2012) subgroup made up of alums with science majors, but not science careers. Many differing subgroup analyses are available for answering a wide array of about that group’s experience.

In sum, this 10-year retrospective evaluation study showed that YES! has functioned to open STEM vision and opportunity to most all of its participants, most of whom would otherwise not have had these doors opened for them. Documenting experiences some of the participants for whom YES! has had the most impact has provided both insight into how YES! functions to achieve both intended and unexpected outcomes. It also provides direction for making future programming stronger.

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Introduction

With funding from the Smithsonian Institution's Youth Access Grants program, the National Museum of Natural History established Science Career Access and Learning Experiences (SCALE) to impact the lives of Washington D.C. teens who otherwise have had limited access to high quality authentic science experiences. SCALE programming involves a pipeline of community collaboration outreach and science events feeding robust out-of-school program offerings, volunteer opportunities, and ultimately, paid internships. These internships have been offered by the museum's YES! (Youth Engagement through Science) program, and more recently the Q?Crew Captains program. In 2019, the museum added to the pipeline continued engagement through an alumni ambassador program. This expansion utilized the 10th anniversary of its YES! (Youth Engagement through Science) internship program as a vehicle for expanding internships to include YES! alumni who multi-functioned as near-peer mentors; liaisons for building a strong alumni network; and data collectors for this study of longer-term YES! impact.

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Moira Ragan, CRE research assistant, is an Educational Research & Evaluation Ph.D. candidate at Ohio University, and has brought to this project expertise in survey design and data analysis. Laura Blanton, Q?rius Educator, and Anna Jaysing, Dumbarton Oaks Humanities Fellow, have led the effort to code all qualitative questionnaire data and conduct and code all follow-up interviews. Their expertise was integral to identifying emergent themes and creating the coding structure.

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The design of this study drew from the 2017 YES! evaluation which, in addition to an outcomes-based questionnaire, included feedback from 39 alumni who averaged three years since completing their internship (range 1 to 7 years). Major findings were that:

Alumni had, since before their NMNH experience, significantly increased their commitment pursuing science studies and careers. Just over half attributed their current academic pursuits and career intentions to their YES! experience. Of the 21st century skills, Alumni highly attributed to their NMNH experience their growth in critical thinking, leadership skills, and sense of identity.

Thirteen alumni respondents identified themselves as active in the Q?rius Alumni Ambassadors program. Six alumni ambassadors provided qualitative feedback that revealed (0.1) awareness of potential benefits such as networking; college selection and application; resume-writing; job search opportunities and training; the opportunity to function as a resource to other students; that the benefit ranged from highly valuable (networking opportunities and continued confidence building) to those who were unclear even about the program's purpose or their role within it.

Methodology and data that produced these results and lessons learned were used for this project's design and implementation.

Research Questions

This retrospective study sought to more thoroughly learn how YES! programming has impacted the lives of youth interns, most of whom were selected into the program because they came from groups under-represented (e.g. female; minority) in the sciences. Moreover, because of its more thorough approach, its intention was to produce important information and direction for creating a functioning and valuable Alumni Ambassador's program. Thus, the study will seek to answer the following questions:

1. To what extent did the YES! high school internship contribute to the intended program outcomes? (As listed in the introduction above:).

2. To what additional (e.g., lifestyle, parenting, etc.) longer-term outcomes did the YES! internships contribute?
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4. Envisioning a vibrant Alumni Ambassadors program. How can NMNH best establish an Alumni Ambassadors Network that will mutually benefit alumni and NMNH youth programming? Sub-questions include: In what ways are Alumni interested in staying involved with each other and NMNH? What benefits might they derive from continued involvement? How might ongoing alumni or cohort connection serve them? In what ways might they be interested in contributing to current YES! interns' current or ongoing experiences? [e.g. in which of the following activities would you participate? What additional ideas do you have?]

Methods

To answer these evaluation questions this study utilized a sequential mixed method exploratory-explanatory design (Creswell & Creswell, 2018) with data coming primarily from online questionnaires completed by YES! alums contacted by peers hired as interns during the summer of 2019. The overall strategy involved completing online questionnaires followed by follow-up interviews of alums selected for the need for explanation of the most informative questionnaire responses. As detailed below, COSI CRE worked collaboratively with NMNH Youth Programs staff, a project research fellow, and alumni interns, some of whom functioned in role of research assistants. These research assistants contacted cohort peers to complete the questionnaire and participate in interviews. Under the direction of COSI CRE and supervision of program staff, the research fellow coded and summarized qualitative responses. And then conducted and analyzed follow-up interviews. The research fellow also participated with program staff in sense making both of both the questionnaire and interview results.

In this section, we describe analyses conducted for answering each of the evaluation questions. The evaluation involved both qualitative and quantitative methodology, using data collected from questionnaires and interviews.

The Questionnaire-Documentation of Instruments and Analyses

The mixed method study utilized data collected from an online questionnaire designed to answer the evaluation questions. Table 1 delineates the questionnaire sections and how each generated data for answering specific evaluation sub-questions. For those sections that produced data for answering question #1 (about intended outcomes) the table delineates the outcome (numbered according to the explanation of outcomes found above). For consistency, the questionnaire utilized the categories and scales from the evaluations conducted over the past 3 years.

Table 1. Questionnaire sections and how they addressed research questions

Research Question	Section	Questionnaire Multiple Select Items	Open ended questions
	Demographics and grouping variable	<p>Program records supplied information about gender and cohort</p> <p>Are you attending or did you attend college? (attending; attended; graduated; planning to attend; on leave but plan to return; did not attend and probably will not attend)</p> <p>Please tell us about your college major (or the one you have planned): (Natural history-related; social science (including education); other STEM-related field, not STEM and not involving natural history; other (please explain).</p> <p>Please tell us about your college minor (or the one you have planned): (Natural history-related; social science (including education); other STEM-related field, not STEM and not involving natural history; other (please explain).</p> <p>Are you attending or did you attend graduate school? (attending; attended with no plans to return; planning to attend; graduated; on leave, but planning to return; did not attend and probably will not attend)</p> <p>Please tell us about your graduate school field (or the one you have planned): (Natural history-related; social science (including education); other STEM-related field, not STEM and not involving natural history; other (please explain).</p>	<p>If applicable, in what field are you working and what is your job title?</p> <p>What school(s) did you attend or are you attending?</p>
<p>Q1. Intended Outcomes. Outcome 1.</p> <p>Content and skill</p>	Science-related content or skill;	<p>What specific skill(s) or content (if any) did you learn? (that helped you as a student; in your work; in your life outside of school or work) (3 qualitative questions).</p>	<p>What knowledge or skills from your YES! internship did you later use in school or college? Specifically, in what ways did you find them useful?</p> <p>What knowledge or skills from your YES! internship have you later used in your work or career? Specifically, in what ways have you found them useful?</p> <p>What knowledge or skills from your YES! internship have you used in your life outside of school or work? Specifically, in what way(s) have you found them useful?</p>

Research Question	Section	Questionnaire Multiple Select Items	Open ended questions
Q1. Intended outcomes. Outcome 2. Interest in and motivation for studying science and science careers	Science Interest	<p>Please select the image that best represents your relationship to science BEFORE your YES! Internship (7 point scale presented as Venn diagrams ranging from 0 to 100% overlap)</p> <p>Please select the image that best represents your relationship to science NOW. (7 point scale presented as Venn diagrams ranging from 0 to 100% overlap)</p> <p>Science Identity (selected items from the Science Identity scale (Cole, 2012))</p> <p>YES! Contribution score for high scorers.</p> <p>Activity attribution high YES! Attribution scorers</p>	
	Academic path	<p>College major, minor, and grad school discipline categories listed in demographic questions above.</p> <p>How much did your YES! experience affect your choice of college major/minor/grad school discipline? (a great deal; a lot; a moderate amount; a little; none at all); three separate questions.</p>	What specifically was (is, will be) your college major/minor/grad school discipline? (three separate questions)
	Career path	<p>Please tell us about your career path (or the one you have planned): Natural history-related; social science (including education); other STEM-related field, not STEM and not involving natural history; other (please explain).</p> <p>How much has your YES! experience affected your career choice or the career you plan to pursue? (a great deal; a lot; a moderate amount; a little; none at all)</p>	<p>Specifically, what is your career path or what do you want it to be?</p> <p>Specifically, what was it about your YES! experience that affected your career choice?</p>
Q1. Intended outcomes. Outcome 3. Science communication	3. Enhance skill and confidence with communicating about science	<p>Science communication scale:</p> <p>In what ways do you use your science communication skills? For each item below, please tell us how much you use each of these skills. Then please tell us how much your YES! experience contributed to your ability to use these skills. –</p> <p>I currently use this skill; (none, a bit, a moderate amount, a lot, a huge amount)</p> <p>How much did your YES! internship contribute to your interest or awareness of the importance of using this skill? (none, a bit, a moderate amount, a lot, a huge amount; I do not use this skill)</p>	Today, in what ways do you apply your science communication skills?

Research Question	Section	Questionnaire Multiple Select Items	Open ended questions
Q1. Intended outcomes. Outcome 4. 21st century skills	Enhance 21st century skills	<p>YES! contribution to 21st century skills</p> <p>Looking back, how much do you think being a YES! intern contributed to your leadership skills and your sense of self?</p> <p>(communication in general; critical thinking; leadership and team member skills; relationship to nature and the environment; self-efficacy) (A great deal; a lot; a moderate amount; a little; none at all)</p>	
Q1. Intended outcomes. Outcome 5. Network building	Creating Networks		Responses from any of the open-ended questions about “specifically, how did YES! contribute?”
Q2. Additional not specifically targeted outcomes		<p>Please tell us about the role of science in your life outside of academics or career. In what parts of your life does your STEM learning play an important role? (parenting; political activism; volunteering; hobbies; other –please describe; no STEM involvement)</p> <p>How much did your YES! experience affect your involvement with STEM outside of school or career? (A great deal; a lot; a moderate amount; a little; none at all)</p>	
Q3. Program Influence	Specific program strategies	Considering all the ways you changed and what you learned as a YES! intern, please rate the relative percentage each of the following YES! experiences contributed to your learning. If you don't recall the event or activity as part of your YES! internship assign "0". With qualitative explanation.	For the three highest scoring activities, please describe how each impacted you and the reason you scored them highly.
Q3. Program Influence	Suggestions for change.	<p>Suggested program improvements</p> <p>What other conditions in your life affected the impact of your YES! experience?</p>	What changes can you suggest that would have made your YES! experience have greater impact?
Q3. Program influence			Specifically, what was it about your YES! experience that affected your choice of college major/minor/career choice/STEM involvement beyond school and work? (four questions)

Research Question	Section	Questionnaire Multiple Select Items	Open ended questions
Q3. Program influence. Extra-program influences	Extra-program influences		What other conditions in your life affected the impact of your YES! experience?
Q3. Program influence. Program experience	Program experience	Basic Psychological Needs Satisfaction and Frustration Scale	
Q4. Alum experience	Alumni experience	<p>Envisioning a vibrant Alumni Ambassadors program:</p> <p>Count of retained contacts: With approximately how many people from your cohort do you remain in contact? (list)</p> <p>For what reasons would you maintain contact with your YES! intern colleagues? (to maintain friendships; to maintain a network for career advancement; to help inform the program; out of curiosity about what they're doing; other – describe; I have no interest in staying in contact with YES! Colleagues.</p> <p>Count of professionals: Please list the names and positions of professionals (staff, researchers, etc.) with whom you remain in contact.</p> <p>For what reasons would you maintain contact with YES! Staff? (to maintain friendships; to maintain a network for career advancement; to help inform the program; out of curiosity about what they're doing; other – describe; I have no interest in staying in contact with YES! Staff)</p> <p>In what ways would you be willing to support current YES! interns? (advice and support applying to or planning for college; conduct college tours; share lessons learned from your YES! Experience; share information about other opportunities at the Smithsonian; attend YES! Presentation events; serve on career panels; other)</p> <p>How interested are you in participating in a support network for YES! alumni? (a great deal; a lot; a moderate amount; a little; not at all)</p> <p>From the list that follows, please select the ways of alumni participation that interest you. (Facebook group; other social media group; alumni directory – what</p>	What additional ideas do you have for keeping YES! Alumni involved with the YES! program?

Research Question	Section	Questionnaire Multiple Select Items	Open ended questions
		<p>are you doing now, how to contact; alum listserv; alum hangout/get together/events; none of the above.)</p> <p>Would you be willing to share information about yourself (e.g. phone number, employment; current occupation; etc.) in an alumni directory? (yes; no).</p> <p>List selection: Reasons for retaining contact with YES! interns</p> <p>List selection: Ways of supporting current YES interns?</p> <p>Additional ideas?</p>	

* outcomes numbered as listed in description of YES! outcomes above.

The YES! at 10 questionnaire (Appendix A) ... Explanations below are arranged first with demographics and then in the order of the evaluation questions.

Demographics

When reporting on their academic and career histories, participants provided specific information (e.g., college majors) along with classifying them as within the categories listed in column 1 of Table 2. Using these data and the other qualitative information provided, the research team ultimately coded fields based on the categories in Table 2 column 2. Where applicable, we have reported using this second set of codes. Because there were limited data regarding college minors, major and minor were collapsed into a single variable giving major emphasis except where the minor was STEM-related (i.e., one code). Table 2 breaks down participants’ fields of study in undergraduate school.

Table 2. Categories for classifying academic and career choices.

Questionnaire categories selected by respondents	Categories coded by researchers
<ul style="list-style-type: none"> • natural history-related; • social science (including education); • other STEM-related field; “ • Not STEM, but involving natural history (e.g. musician who sings about climate change); and • not STEM and not involving natural history. 	<ul style="list-style-type: none"> • Natural science; • Social science; • TEM (technology, engineering, and math); • Medicine/pre-med; • Other; • Undecided; • Business; • Student.

Q1. Contribution to long-term intended outcomes

To measure contribution to long-term outcomes, the questionnaire included sections addressing intended outcomes as outlined in the YES! Logic model, utilizing measures comparable to those used in earlier outcome studies.

Outcome 1. Content and Skill.

Four open-ended questions elicited information about outcomes related to acquisition of specific content or skill. These questions, listed in Table 1 above, related to “knowledge or skills” later used academically (major and minor), in work or career, and outside of school or work. For each of these three areas or potential knowledge or skill application, respondents also provide specifics about how they were applied.

Emergent themes that guided coding included: clarified interest; developing interest in specific; drove interest in a specific topic; fostered interest; or functioned as a stepping stone to current interest.

Outcome 2. Science Identity and Interest in Science Academics and Career

Multiple measures and open-ended questions provided data for answering this part of the outcome question. Built into the questionnaire were questions about science identity, science interest, academic major and minor; career choice; and application of science outside of career.

To give an overall sense of how participants feel about their science identity, participants chose one of seven Venn diagrams (Figure 1) with the instructions: “The Venn diagrams below represent you (blue) and science (green). The images represent relationships that range from having no interest in or involvement with science (at the far left) to being totally identified and involved with science (on the far right). The middle image represents about half of your life involved with science and about half involved with non-science related interests and pursuits.”

Two items followed. (1) “Please select the image that best represents your relationship to science BEFORE your YES! internship.” (2) “Please select the image that best represents your relationship to science NOW.” The choices represented seven degrees of overlap ranging from none-at-all to one-and-the-same, with the middle choice presenting a 50% overlap.

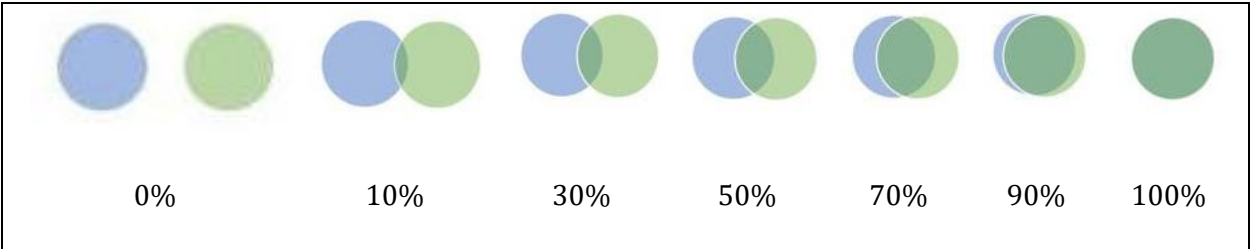
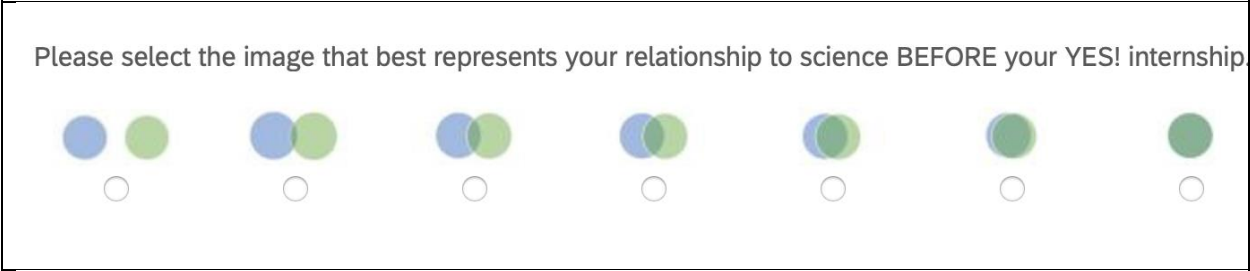
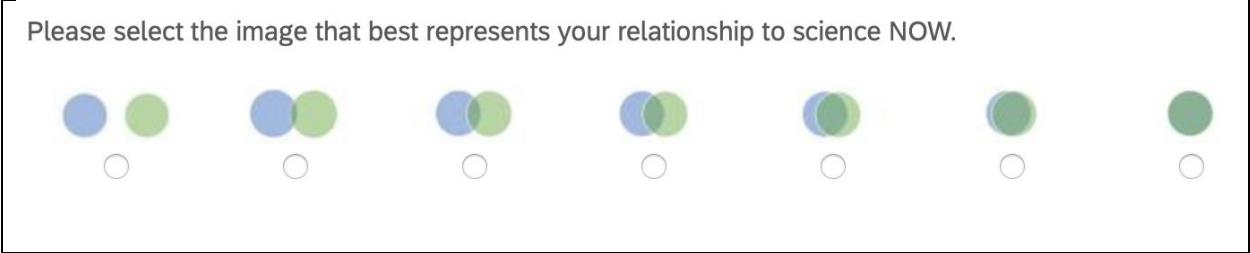

Please select the image that best represents your relationship to science BEFORE your YES! internship.

Please select the image that best represents your relationship to science NOW.


Figure 1. The Venn diagram questions about participants' relationship with science

Recently a similar single item measure, the STEM Professional Identity Overlap measure (McDonald, Zeigler-Hill, Vrabell, & Escobar, 2019) demonstrated convergent, discriminant and criterion validity.

Science Interest. The Science Identity Scale from the Science Identity Survey (Cole, 2012), designed and psychometrically tested as part of an evaluation of the 2009 informal scientific education programs at the Chicago Museum of Science and Industry, was used to measure changes in science identity. Three relevant subscales (daily life, personal traits, and value) include items

such as “In my daily life, I am aware of using scientific thinking,” “I watch science-based videos just for fun,” and “I find science is useful in helping to solve the problems of everyday life.”

YES! Contribution to Academic major, minor, and grad school discipline choice

Participants reported how much their YES! experience affected their choice of college major and minor (a great deal; a lot; a moderate amount; a little; none at all). Then, based on their response, we grouped participants into high and low effect groups. The high effect group comprised those who indicated “a great deal,” “a lot,” or “a moderate amount.” The low effect group comprised those who indicated “a little” or “none at all”.

YES! Contribution to Career paths

To study whether program alumni chose career paths related to science as well as the YES! program’s influence on their choice of careers, we asked participants to provide their current or planned career path, its field, and how much their YES! experience affected their choice of career path (a great deal; a lot; a moderate amount; a little; none at all). We again grouped participants into high and low effect based on how much they indicated their YES! experience affected their choice of career path. We coded those who indicated “a great deal,” “a lot,” or “a moderate amount” as high effect and those who indicated “a little” or “none at all” as low effect.

Outcome 3. Science Communication

To assess science communication skills the YES! internship contributed to those skills, the questionnaire included a section on science communication adapted from the Science Communication Competence Index, an assessment tool developed by Kulgemeyer and Schecker (2013). To rate their current use of various science communication skills, participants responded to 13 items, first in relation to whether they currently use this skill (a huge amount; a lot; some; a bit; none) and second, the degree to which they perceive their YES! experience as contributing to their ability to use the skill (a huge amount; a lot; some; a bit; none).

They then answered the open-ended question, “Today, in what ways do you apply your science communication skills?”

We computed the average across all 13 items for both participants’ identification with the communication skill as well as how much they attributed YES! with contributing to that skill.

Responses to the open-ended question were coded for emergent themes.

Outcome 4. Improved 21st Century Skills (leadership; and identity)

The term “21st century skills” generally describes the skills, knowledge, and expertise necessary for life and work success in the post-modern world. Many varied frameworks exist for understanding these skills (Dede, 2010). For purposes of coding qualitative responses, we have adopted a broad view based on Partnership for 21st Century Learning (Batelle for Kids, 2008), visually conceptualized in Figure 2. This view includes both innovation and learning skills which include communication, creativity, innovation, problem solving, and critical thinking as well as life and career skills that include flexibility/adaptability; initiative and self-direction, and leadership and responsibility. Alum descriptions of how the YES! experience affected pathways to current status described these kinds of qualities as well as the associated sense of efficacy and identity that accompanied acquiring them.

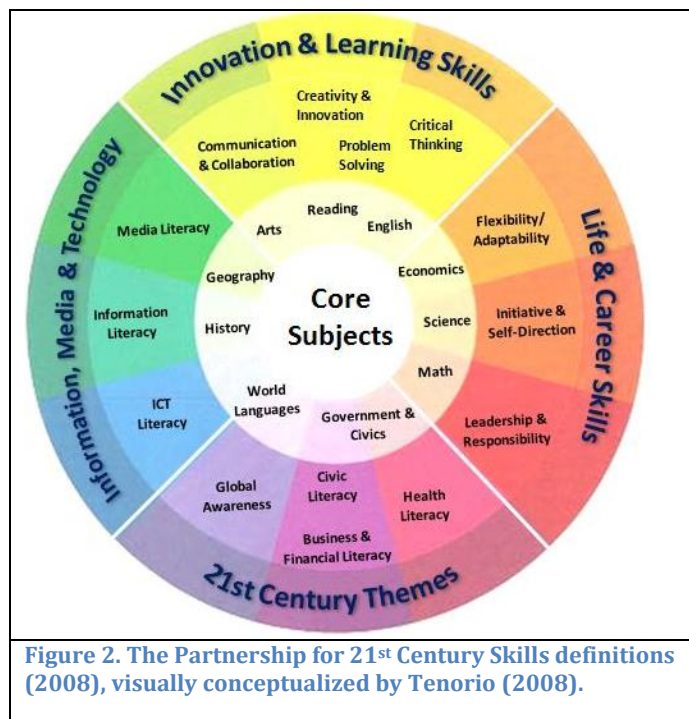


Figure 2. The Partnership for 21st Century Skills definitions (2008), visually conceptualized by Tenorio (2008).

Thus, we coded comments related to these broad categories and definitions. Self-efficacy and confidence were coded independently through the questions, however for the report these themes mostly fall under the category of initiative and self-direction.

To understand NMNH impact on 21st century skills, we included in the questionnaire a section on leadership and sense of self. Following previous YES! evaluations, we measured respondents’ retrospective perception of the effect of the YES! experience on leadership skills and personal identity with 11 items adapted from two positive youth development sources: (Damon, 2004; Koke, Heimlich, Kessler, Ong, & Ancelet, 2007). In response to instructions that read “Looking back, how much do you think being a YES! intern contributed to your leadership skills and sense of self?” and statements about leadership and self (see results Q1 Outcome 4), respondents rated items on a five-point scale (a great deal; a lot; a moderate amount; a little; none at all). In addition to individual item statistics, the average across all 11 items was calculated.

Outcome 5. Networking

To answer the question coding interviews transcripts and written responses to three open-ended questionnaire items led to answering the evaluation question about networking outcomes. Questionnaire items included the three questions about how respondents had used YES! knowledge or skills (1) academically, (2) in the workplace, or (3) beyond, and how respondents found those skills useful.

Responses were then divided into two types of networking – within and beyond the YES!/NMNH Network. Responses were further divided into categories of valuing the skills and applying the skills.

Q2 Contribution to additional, not specifically targeted outcomes.

A questionnaire section on participants' lives outside of school and work elicited data about their science-related activities and their perception of how much their YES! experience affected their choice to be involved. First, participants reported in what parts of their lives STEM plays an important role (parenting; political activism; volunteering; hobbies; other; no STEM involvement). Second, participants quantified how much their YES! experience affected their involvement with STEM outside of school or career (a great deal; a lot; a moderate amount; a little; none at all). Again, we grouped participants into high (a great deal, a lot, or a moderate amount) and low effect (a little, or none at all). We also ran descriptive statistics of both items before also running the second question by high and low effect.

Q3. Influence of Specific Program Components

To better understand how well various programming strategies contributed to the outcomes participants experienced (i.e., which program components affected participant development), we asked participants to assign a relative percentage to 10 program activities to account for their respective contributions. We calculated the mean percentage for each activity. Not all cohorts experienced each strategy. Table 3 shows the strategies available to each cohort. Descriptions of each strategy follows.

Table 3. Program strategies per YES! participation year.

Strategy	Participation Year								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
College Preparatory Workshops.	x	x	x	x	x	x	x	x	x
The Research Project.	x	x	x	x	x	x	x	x	x
Behind the Scenes Tours and Field Trips at the Smithsonian.	x	x	x	x	x	x	x	x	x
Science Communication Workshops.	x	x	x	x	x	x	x	x	x
Public Engagement with Museum Visitors.	x	x	x	x	x	x	x	x	x
Community Day Project.					x	x	x	x	x
TED-Ed-Style Videos (YES! 1.0 and 2.0).							x	x	x
Intern Is In.	x	x	x	x	x	x	x	x	

Program Strategy Descriptions.

The Research Project with science mentors is the core of the YES! program. Each intern works on individual projects with Smithsonian scientists and science staff around the Institution. Examples of mentor locations include NMNH, the National Zoo, Smithsonian Gardens, and the National Air and Space Museum.

Behind the Scenes Tours and Field Trips at the Smithsonian. Over the summer, interns participate in a series of behind-the-scenes tours and conversations with curators and collections managers to learn about the 145 million objects in the museum's collections and how scientists use

them to study our world. They also take field trips to other Smithsonian sites, including the Smithsonian Environmental Research Center, National Zoo, and National Air and Space Museum to explore science careers in a variety of contexts.

Science Communication Workshops. Through a series of interactive workshops to help the interns advance their oral and written communication skills, participants learn guidelines and examples for communicating and presenting as real-world professionals, mainly in an informal science setting.

Public Engagement with Museum Visitors. During the summer, YES! interns spend time interacting with the public by facilitating their own Intern is In and Community Day experiences in Q?rius.

Community Day Project. This project is an opportunity for all YES! interns to share a component of their Research Project with the general public. The goals of this project are for interns to share their personal experience while creating a two-way dialogue with visitors. Interns have an opportunity to share this with their families, principals, peers, Museum visitors, and the NMNH science community on Community Day.

TED-Ed-Style Videos (YES! 1.0 and 2.0). The goal of this project is to help the interns move beyond their personal experience to communicate scientific issues and research. During fall session (eight Saturdays in August and September), each intern creates their own TED-Ed style talk based off of their Research Project and science experience over the summer. Interns learn about presentation skills and effective storytelling in order to develop a creative and effective talk. These talks are professionally filmed and shared locally.

Scientific Posters (YES! 2.0 & 3.0). YES! 2.0 & 3.0 interns develop professional scientific posters in order to communicate the research they have conducted. Interns learn about writing, design, and presentation skills. They present the posters to an audience of peers and visitors during Community Day.

Reach 100 Initiative (YES! 1.0 & 2.0). After the fall session, interns are challenged to reach 100 of their peers and/or community members with their presentations. By acting as ambassadors of the YES! Program, interns spread the word about YES! while also extending its reach.

While several of these program components have occurred throughout YES!, many have evolved. Science communication training occurred in three time arcs with different staff members: Arc 1 began in 2010 with Cristina Castillo and Charles Brit, and then continued from 2011-2013 with Elio Cruz and Charles Brit; Arc 2 from 2014-2015 with Erika Wright; and Arc 3 began in 2016 with Dawn Quill and continued from 2017- 2019 with Ben Taylor. From 2014-2015 science communication training focused more on activity development and interacting with visitors within the museum. Training from 2016-until the present saw the incorporation of the TED-Ed Style videos. Intern Is In, while taking place every year, has also gone through multiple iterations. Community Day as an element first started in 2014. While College Preparatory training has also been present throughout YES!, there are years during which the training was stronger than others.

Open Ended Question Asking Respondents to Explain their Program Strategy Ratings

To provide data for more deeply understanding the strategy ratings, study alums responded to the request: For the three highest scoring activities, please describe how each impacted you and the reason you scored them so highly.

We then coded the responses into 5 emergent codes:

Direction: references to academic or career path development, range of academic or career opportunity awareness, academic or career preparedness, personal academic or career interest or passion.

Exposure: references to awareness of opportunities afforded by diversity, museums, new information, politics, science, or scientists.

Skill/learning: references to acquisition, use, interest, opportunity, or value of skill or knowledge involved with learning in general or STEM specifically; communication (both science and general); and personal development;

Social: references to the presence, quality, formation of, or opportunities for forming, relationships with friends, professional networks, peer connections, family, or relationships in general.

Value: references to affecting or inspiring others.

Why: traits (e.g. fun, enjoyable, memorable) that made activities or people effective.

Q4. Visions for a vibrant Alumni Ambassador Program

Interviews

To more deeply understand the survey results, the mixed method research design included interviews with 12 selected alums whose questionnaire responses demonstrated high program effect. Success case selection would provide a means for seeing how well the program could succeed in order to set goals for making these success cases the norm. Structured interview questions were designed to more deeply understand how the YES! experience influenced these people's academic and career choices as well as their relationships to science outside of school and work. The NMNH research fellow conducted all 13 interviews which were then professionally transcribed. An emergent coding scheme was developed first by five of the alum interns and then refined by the NMNH research fellow and the staff evaluation project staff member.

Participant Selection and Recruitment

Evaluators and staff selected interview participants based on qualitative and quantitative questionnaire responses. Success case selection sought representation of *high program effect* generally representing a range of career or academic effect, each in natural history, other science, not science but TEM, and not STEM. In addition, we sought to include respondents who reported

high effect that reached beyond academics or career. Selection was also made so the final pool would represent gender proportions reflective of the program, and also representation across cohorts.

Program staff invited selected participants via email, text, or phone using the script for invitation (below), explaining this aspect of the study and using the consent information sheet provided by COSI CRE. Consent to participate in the interview was assumed when the respondent scheduled the interview. As per the interview script, all interviews began with acknowledgement of having read the consent information sheet and an opportunity to ask any additional questions. All selected respondents were adults. A \$40 incentive was provided for interview participation.

The NMNH interviewer then contacted each participant at the arranged time and conducted the interview according to the interview script below. With permission from the participant, the interviewer recorded the conversation and/or took detailed notes to ensure accurate documentation of responses.

Script for Invitation

Hello! You are receiving this email because you took part in the NMNH YES! at 10 Alumni survey. We are looking to create a rich understanding of ways that the YES! program can influence lives and your story is particularly interesting.

Might you be willing to participate in a 20-30 minute phone call or video chat one of our staff members? Please respond to this email and return the attached consent form with your signature. As an appreciation of the time you are providing us, you will receive a \$40 gift card.

Thank you so much for your YES! at 10 feedback and your important contribution to future YES! interns.

Script for Interview

The interviewer will initiate the interview by welcoming alum and thank them for participating in the interview.

Greet

The interviewer will introduce the interview with a description of the study such as: Hi, I'm _____. Thanks so much for participating in this study. As you know from the consent information, we are conducting interviews lasting 20-30 minutes to find out how your YES! experience affected you and what you're doing now. Do you have any questions about the study or your consent? [Answer any questions the participant may have]

Permission to Record

Will it be OK with you if I record this interview?

[If not], that's ok, I'll take careful notes. I may need to stop the conversation to catch up and make sure I've captured just what you've told me.

[If so,] Great let's get started.

Questions and prompts

1. Warm up question to be determined by interviewer. Examples: Can you tell me one of your favorite memories from your YES! Experience? How did it feel to fill out the questionnaire? Thank you for filling out the questionnaire, I really enjoyed reading about . . . etc.
2. In your responses, your referenced __; can you tell me more about that?
3. What was it about the YES! program that fostered this (these) experience?
4. What other parts of your life does that experience affect? Your job, your career, your family life? Your social life?
5. In what ways do you pass on your YES! experience to others?
6. What additional feedback do you have for the YES! program and how it can best function to meet teens' science and research interests and needs? (can we just cut this if it isn't working in interviews)

Summarize

"I heard you say these things . . . **Ask:** is there anything more you'd like to add?"

Member Checks

After narratives based on the interviews were written, staff reached out to interview participants to secure consent.

Script for Securing Written Narrative Consent

On behalf of the Education, Outreach, and Visitor Experience Department at the National Museum of Natural History, thanks SO much for your participation in the YES! @10 Evaluation! For our final report we are writing up short story bios based on each interview we conducted. We want to make sure we've represented you and your story accurately. Would you read over what we wrote and let us know?

You'll find a copy of your short story attached to this email. Please take a few moments to review it to ensure its accuracy. Note that in these narratives we are refraining from using proper names that may deter our efforts to protect interviewee anonymity. But please let us know if there's anything we should change or add or, for privacy purposes, anything you want us to delete.

As we are writing this report and are also strongly considering a journal publication on our results and/ or methodology for this project, we want to ensure that everyone featured is informed of and comfortable with this. Please respond to this email to inform us of any desired changes, and whether or not you consent to us including this narrative in our report and potential publication(s). If we do not hear back from you by [specified deadline] we will interpret this as consent.

Your insight and willingness to share about your personal experience with YES! Has tremendously helped us in gaining a better understanding of the scope and impacts of this program and will inform future decisions regarding the program's growth and trajectory.

Please do not hesitate to reach out with any questions.

The Sample: Description of the Data

Questionnaire Respondents

Nine Alumni Ambassador Interns hired for the summer of 2019 sent email invitations to the remaining 163 YES! alums (172 total including ambassador interns) and sent them links to the YES! at 10 questionnaire (Appendix A). Overall, 102 alumni completed the questionnaire, including the nine ambassador interns, producing a 60% participation rate. The Alumni Ambassador Interns contacted their peers from their respective internship year from 2010 to 2018. We created three cohorts (i.e., 2010-12, 2013-15, 2016-18) to assess shorter- and longer-term program impacts. The cohort groups were relatively similar in size at 31, 38, and 33 respectively. For some research questions, we conducted additional analysis by cohort and/or gender. Table 4 describes the participants in terms of cohort and gender.

Table 4. Description of respondents by Gender and Cohort

Cohort	Male		Female		Total	
	n	%	n	%	n	%
2010-12	11	31%	20	30%	31	30%
2013-15	18	50%	20	30%	38	37%
2016-18	7	19%	26	39%	33	32%
TOTAL	36		66		102	

Overall, 58% of alumni responded to the questionnaire. Of this group males responded at a higher rate (67%) than females (54%). However, as shown in Table 5, this difference occurred primarily among the middle (2013-15) cohorts. And somewhat so in the most recent (2016 to 2018) cohorts. Gender difference in response rate was negligible among the older alums.

Table 5. Description of non-respondents

Cohort	Female			Male			Total		
	Non-Response	Response	Response Rate	Non-Response	Response	Response Rate	Non-Response	Response	Response rate
	n	n	%	n	n	%	n	n	%
2010-12	17	20	54%	8	11	58%	25	31	55%
2013-15	23	20	47%	7	18	72%	30	38	56%
2016-18	17	26	60%	3	7	70%	20	33	62%
TOTAL	57	66	54%	18	36	67%	75	102	58%

Participants provided data regarding their college status. Nearly 50% were currently attending college at the time of the survey. Table 6 illustrates the participants' college status.

Table 6. Participants' reported college status or plans

	2010-12		2013-15		2016-18		Total	
	n	%	n	%	n	%	n	%
Attending	4	13%	23	61%	22	67%	49	48%
Graduated	21	68%	10	26%	-	-	31	30%
Planning to attend	-	-	3	8%	11	33%	14	14%
Attended	3	10%	1	3%	-	-	4	4%
On leave; but plan to return	2	6%	1	3%	-	-	3	3%
Did not attend and probably will not attend	1	3%	-	-	-	-	1	1%
TOTAL	31		38		33		102	

Participants also provided information about their graduate-school plans or experience. In addition to their status (attending; attended with no plans to return; planning to attend; graduated; on leave, but plan to return; did not attend and probably will not attend), participants provided their subjects and field of study. Approximately 40% of both men and women pursued majors or minors in natural science. Beyond the natural sciences, they differed. Not surprisingly, approximately 35% of female respondents majored in the social sciences as compared to 15% of males; 35% of male respondents majored in technology, engineering, or math compared to approximately 15% of females (Table 7).

Table 7. Participants' reported major or minor coded by field

	Male		Female		Total	
	n	%	n	%	n	%
Nat science	14	41%	24	37%	38	38%
Social science	5	15%	25	38%	30	30%
TEM	12	35%	9	14%	21	21%
Business	1	3%	4	6%	5	5%
Med/pre-med	1	3%	2	3%	3	3%
Other	-	-	1	2%	1	1%
Undecided	1	3%	-	-	1	1%
Student	-	-	-	-	-	-
TOTAL	34		65		99	

In line with the college and career variables, we recoded the graduate-school field per the research team's coding structure. Table 8 and Table 9 delineate participants' graduate-school experiences – which differed significantly between females and males. As shown in Table 8, despite plans among women to attend graduate school (65%), more women than men (24% and 17% respectively) had

no plans to attend and more men than women (28% compared to 8%) were actually attended. On the other hand, only one person, a female, had graduated.

Table 8. Participants' reported graduate-school status or plans

	Male		Female		Total	
	n	%	n	%	n	%
Planning to attend	19	53%	43	65%	62	61%
Did not attend and probably will not attend	6	17%	16	24%	22	22%
Attending	10	28%	5	8%	15	15%
On leave; but plan to return	1	3%	1	2%	2	2%
Graduated	-	-	1	2%	1	1%
TOTAL	36		66		102	

In contrast to college major and minors, male alums pursued or planned to pursue natural sciences in grad school (Table 9) at twice the proportion as female alums (41% vs. 21%). Similar to undergraduate experience female alums more often pursued or planned to pursue social science fields (33%) in graduate school than did male alums (11%).

Table 9. Participants' reported graduate-school field

	Male		Female		Total	
	n	%	n	%	n	%
Nat science	11	41%	9	21%	20	29%
Social science	3	11%	14	33%	17	25%
TEM	5	19%	7	17%	12	17%
Med/pre-med	2	7%	6	14%	8	12%
Business	3	11%	3	7%	6	9%
Other	2	7%	2	5%	4	6%
Undecided	1	4%	1	2%	2	3%
Student	-	-	-	-	-	-
TOTAL	27		42		69	

As for the types of schools alums attended, most attended national universities rather than private or regional colleges as shown in Table 10.

Table 10. Schools attended by type

	n	%
University	80	72%
National	78	70%
Public	50	45%
Private	43	39%
Regional	16	14%
Unidentified College	12	11%
Community college	5	4%
TOTAL SCHOOLS	111	

Interview Understanding the Research Questions from the perspectives of 13 Yes! Alums

To set the stage for understanding the responses to the exploratory questionnaire, we first present 13 stories about the lives of individual alums, selected for interviews because their stories illustrated some of the most successful or more interesting findings from the exploratory data. Each story begins with a description of their YES! experience, academic experience and career interest, followed by a description of the rationale for selection for an interview. In the tables below, we've indicated how the different interviews fit into the different research questions (Table 11) as well as the overall emergent themes from the interviews (Table 12).

The interviews provided perspective on the experiences of alums that indicated YES! had a high effect over the course of the past ten years. These perspectives allow insight into the variety of impacts as well as how time interacts with impact, as interviewees ranged from participating in the 2010-2018 cohorts. Despite the different directions interviewees took in their academic and career paths, there were some common themes that emerged such as personal development, increased confidence, mentorship and revelations/ changed perceptions.

The impact with the most instances, revelations/ changed perceptions, encapsulates a variety of experiences- from realizing what they themselves were capable of doing, to creating a different perception of the nature of science, to breaking down preconceived notions of who a scientist is. The theme of personal development indicates that this experience was formative in their personal development- impacting interviewees' sense of self, independence living in and navigating the DC area, and also their social life. Increased confidence was coded separately from personal developments and notes a general change in perception in their own capacity, but this confidence among the interviewees ranges in confidence socially, academically, and professionally. Finally, many of the interviewees indicated that having a mentor through the YES! experience impacted their experience. While the impact varied from general empowerment to causing a shift in consideration of who practices science, mentors clearly played a valuable role in shaping the experience of these YES! alums and empowering them throughout. Several additional interesting themes that several interviewees brought up were a heightened interest in STEM education,

transferring skills gained through YES! to other areas of work and life, and holding the door open for future students interested in exploring STEM fields more. The interview short stories included in this study are:

- F8: The Art of STEM (and Politics)
- F1: Sisters in STEM: Blazing a Path Forward for Herself and Others
- M1: Forging a Science Career: Understanding, Utilizing, and Disseminating Resources
- M3: Metamorphosis of a Scientific Illustrator
- F10: The Good Fight: Making Science Accessible Through Formal Education
- F6: A Sense of Self in Diversity
- M2: Pursuing a Staircase of Opportunity at NMNH
- F5: Paying It Forward: Starting a Non-Profit
- F7: Identifying Stereotypes and Redefining Roles in STEM
- F2: Passing It On: Building Efficacy to Deconstruct Perceived Barriers
- F4: Confidence to Pursue STEM Through a Government Lens
- F3: Inspired by an Effective Mentor
- F9: Pre-Med Confidence While Challenging Scientist Identity Stereotypes

Table 11. Inventory of alumni stories and the questions they help to address

	Title	Q1. Intended Outcomes					Q2	Q3	total
		1.1 Content and skill	1.2 Pursuing science	1.3 Science Communication	1.4 21 st Century Skills	1.5 Networking	Additional Outcomes	Program Strategies	
F8-10	The Art of STEM	x	x		x		x	x	5
F1-11	Sisters in STEM: Blazing a Path Forward for Herself and Others		x		x	x	x		4
M1-12	Forging a Science Career: Understanding, Utilizing, and Disseminating Resources	x	x	x	x	x	x	x	7
M3-13	Metamorphosis of a Scientific Illustrator	x	x	x	x	x	x	x	7
F10-13	The Good Fight: Making science accessible through formal education	x	x		x	x	x	x	6
F6-13	A Sense of Self in Diversity		x		x	x	x	x	5
F2-13	Passing it on: Building efficacy to deconstruct perceived barriers	x	x		x		x		4
M2-14	Pursuing a Staircase of Opportunity at NMNH	x	x		x	x			4
F7-15	Identifying Stereotypes and Redefining Roles in STEM				x	x	x	x	4
F5-15	Paying It Forward: Starting a YES-like non-profit		x	x	x	x	x	x	6
F4-16	Confidence to pursue STEM through a Government Lens	x	x	x	x	x	x	x	7
F3-17	Inspired by an Effective Mentor	x	x	x	x	x	x	x	7
F9-18	Pre-Med Confidence while Challenging Scientist Identity Stereotypes	x	x	x	x	x	x	x	7

Table 12. Emergent themes from the Interviews.

						Engaging Others			Personal Development				Types of Intended outcomes achieved*	Code frequency
		Demographic Background	Importance of Diversity in the Program	Mentorship	Stepping Stone: staircase of opportunity	Engaging Others in STEM	Access	Women in STEM	Increased Confidence	Revelations / Change Perceptions	Conferred Legitimacy	Personal Development		
F8-10	The Art of STEM				X						X	X	7	10
F1-11	Sisters in STEM: Blazing a Path Forward for Herself and Others			X	X	X		X	X	X	X	X	7	15
M1-12	Forging a Science Career: Understanding, Utilizing, and Disseminating Resources	X		X	X	X	X					X	5	11
M3-13	Metamorphosis of a Scientific Illustrator									X		X	4	6
F10-13	The Good Fight: Making Science Accessible through Formal Education	X		X		X				X			0	4
F6-13	A Sense of Self in Diversity	X	X	X					X	X		X	5	11
F2-13	Passing it on: Building Efficacy to Deconstruct Perceived Barriers	X		X	X		X		X	X		X	6	6
M2-14	Pursuing a Staircase of Opportunity at NMNH				X					X		X	7	10
F7-15	Identifying Stereotypes and Redefining Roles in STEM	X				X		X		X		X	6	10
F5-15	Paying It Forward: Starting a YES-like non-profit	X	X	X	X	X	X	X	X	X		X	4	14
F4-16	Confidence to pursue STEM through a Government Lens				X				X	X	X		4	8
F3-17	Inspired by an Effective Mentor	X	X	X					X	X		X	7	13
F9-18	Pre-Med Confidence while Challenging Scientist Identity Stereotypes		X	X		X	X		X	X		X	7	14
		6	4	7	6	5	3	3	6	10	3	10	12	
* See Table 11 for detail														

YES! Alum Interview Profiles

F8. The Art of STEM (and politics)

Through her written and verbal responses, F8 illustrated how the YES! Experience inspired her. Currently an artist and business owner, she exemplifies an unintended outcome of the YES!

Experience- transferrable skills. This outcome is explored more in depth later in the report, however F8 articulated how she utilizes the content and science communication skills she gained during YES! as a volunteer and as an artist seeks inspiration from nature and uses her understanding of the process of doing science and applies it in her current profession as an artist.

F1. Sisters in STEM: Blazing a Path Forward for Herself and Others

F1's story from YES! encompasses sparking an initial interest in STEM to becoming a technology consultant at the time of the interview tells of personal empowerment, creative problem solving, and mentorship. She shared her experience after YES! in pursuing STEM opportunities, realizing the need for more information for teens interested in pursuing paid internship opportunities as well as the need for making space for females in STEM and taking action towards mitigating both concerns. From working with her sisters to attain post- YES! NMNH internships together to building networks to help and support fellow females in and interested in STEM, her story shows one possible answer to where this stepping stone concept may lead to.

M1. Forging a Science Career: Understanding, Utilizing, and Disseminating Resources

A PhD student at the time of the interview, M1 intends on becoming a research scientist and thus exemplifies building upon the YES! experience to pursue a science career path. After YES!, he went on to apply for and participate in a myriad of programs that gave him the opportunity to further and hone his science interests, one of which was the Natural History Research Experience (NHRE) at the museum. His ability to find these resources and leverage his network for pursuing his interest in science shows his self-motivation and career navigation skills.

M3. Metamorphosis of a Scientific Illustrator

M3's identity and career interests underwent a change due to experiences and knowledge he gained throughout YES!. Through learning about science education and beginning to see himself as an educator, he gained the confidence and awareness to think more deeply and critically about his future and identity. Through gaining insight into the variety in science related careers, he sought out a scientific illustrator on staff and, as of the time interviews were conducted, was pursuing a graduate degree in medical and biological illustration in order to educate others through visual sources.

F10. The Good Fight: Making Science Accessible Through Formal Education

F10 shared that through YES!, she gained greater career clarity, a better understanding of the nature of science, and stronger science communication skills. From her experience, she began considering: *how do I take what I've learned and applied in different contexts?* While she was considering what skills and knowledge she had from this experience were transferrable, she noticed that other cohort members were doing the same thing. She realized that she was interested in combatting the accessibility of science education and decided to pursue a Masters in Education so that she could work with and impact STEM education.

F6. A Sense of Self in Diversity

For F6, YES! provided her with a greater sense of the impacts of similar youth programs. While putting her in new environments and building confidence in her ability to work within spaces she'd previously been uncomfortable in, the program also introduced her to scientists and staff members that shared similar experiences and backgrounds to her. This experience helped inspired her to

create similar environments for other youth, and at the time of her interview she was a Youth Development worker at a non-profit in DC that she had also been involved in.

M2. Pursuing a Staircase of Opportunity at NMNH

M2. Participating in YES! 1.0, 2.0, and 3.0 and then pursuing additional undergraduate internships at NMNH shows how M2 has used the internal NMNH pipeline and built upon it afterwards to better understand his career and academic interests. His story shows how YES! shaped and guided his science interests from paleobiology to invertebrate zoology, as well as how he developed and effectively used his network. M3 at the time of his interview was an undergraduate student considering his graduate school options in order to pursue a career in biology or marine biology.

F5. Paying It Forward: Starting a non-profit

While she was always interested in science, F5 shared that she wasn't sure what the next steps would possibly be for pursuing a science interest. By seeing the variety of science related careers and interacting with scientist mentors and YES! program staff; she gained the opportunity to build relationships with mentors who looked more like her and were also first-generation college students, develop professional skills such as communication, and build a greater sense of self-efficacy. After YES!, she along with two other friends- including F7- built a non-profit geared towards young minority women interested in STEM, art, and politics. While she utilizes her communication skills gained through YES! in her current job as an Electrical Engineering Engineer Assistant, she also helps build pathways for future women in STEM through her non-profit.

F7. Identifying Stereotypes and Redefining Roles in STEM

As of her interview, F7 is a student interested in pursuing Computer Sciences or Business Administration in graduate school. Coming from a family in which others hadn't finished their formal education yet were supportive of her interests, F7 articulated in her response's the impact of seeing a variety of career and professionals had her interests. YES! changed her perception of who did what jobs, and led to a greater awareness that female representation was not even across the different fields of science. This awareness sparked a passion in her for making space for more women in STEM. Her friendship with F5 strengthened this passion and provided an outlet- the non-profit F5 was starting- in which to invest her passion.

F2. Passing it On: Building Efficacy to Deconstruct Perceived Barriers

Interested in biology in high school, F2 found out about the YES! internship and decided to pursue it in order to further her interests. What she found in the YES! program was the opportunity to build relationships with mentors and museum staff, deconstructing her concept of who could do science and allowing space for her to be a scientist and pursue science fields she previously knew nothing of or thought inaccessible. Through this experience, she gained a sense of self-efficacy that propelled her to seek out more STEM opportunities, anthropology and engineering fields of study and careers, and a passion for creating pathways for future STEM professionals.

F4. Confidence to pursue STEM through a Government Lens

F4's responses showed how entering into the YES! program and participating in research as well as gaining transferrable skills such as science communication skills supported her in her academic and

career trajectory. As of her interview, she is pursuing a double major in college that will help her pursue a career as an urban planner that specializes in sustainability. Participating in research not only changed her concept of the nature of science and its practitioners, but also made her more comfortable discussing and dealing with STEM research pertaining to government and confident in pursuing these sorts of opportunities.

F3. Inspired by an Effective Mentor

Through participating in YES! 1.0 and 2.0 F3 gained clarity concerning her academic interests, as well as the confidence and support to pursue her interests. Through her time at NMNH she had the opportunity to participate in science in a variety of environments and thus realize that she had a place within those environments. Important to these experiences and encouraging her academic development was her mentor during her 2.0 year. Through building a genuine relationship and forging connections through shared elements of their backgrounds, he was able to provide encouragement and advice that have proven truly impactful on F3's trajectory.

F9. Pre-Med Confidence while Challenging Scientist Identity Stereotypes

While F9's responses show how YES! strengthened her interest in pursuing a STEM career, and at the time of the interview indicated that she plans on going to medical school, her story also shows that the program impacts radiate out and impact her self-efficacy and motivation as well as her perception of STEM education, who can be a scientist, and the interconnectedness of STEM fields. Due to her experience having others open the doors for her to have this experience, she aspires to similarly hold the doors open for others coming after her.

Results Q1. YES! Long-term Contribution to Intended Outcomes

The research question: Q1. In what ways did the YES! Internship contribute to participants' choices in the following areas: (1) promoting and affecting interest in science and science careers (including how the experience affected pre-program career interests) and affecting identity as a science learner or practitioner (2) comfort with communicating about science, (3) specific skills related to science, natural history and cultural research; (4) and 21st century skills (including, communication; critical thinking; creativity; leadership; and social and emotional literacy)?

Q1 Outcome 1. YES! Contribution to Science –Related Content and Skill

What We Learned

YES! Alum respondents reported applicable content learning that spanned across workplace and career know-how, academic know-how, personal development, science knowledge, and ways of encouraging others. Figures 3 through 6 show, for each of these categories the range of topics within each and the relative frequency they were mentioned. As can be seen by the size of each word cloud, by far alums described most knowledge content and skills useful for careers and in the workplace. The content of what YES! interns learned is apparent. How they learned and in what ways they applied their learning is the subject of the sections that follow.

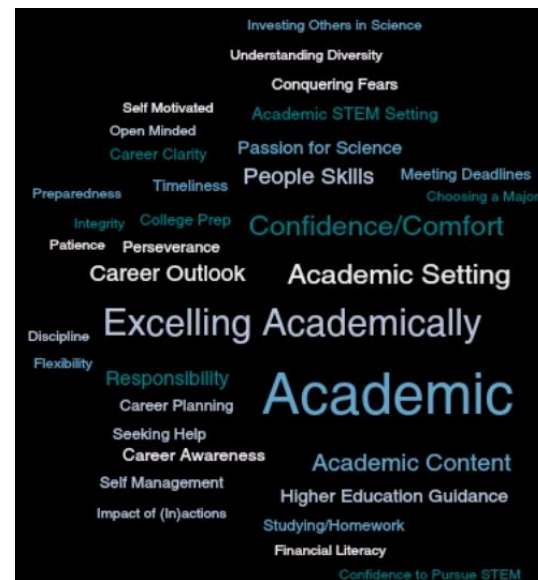


Figure 3. Career knowledge and skills

Figure 4. Academic knowledge and skills

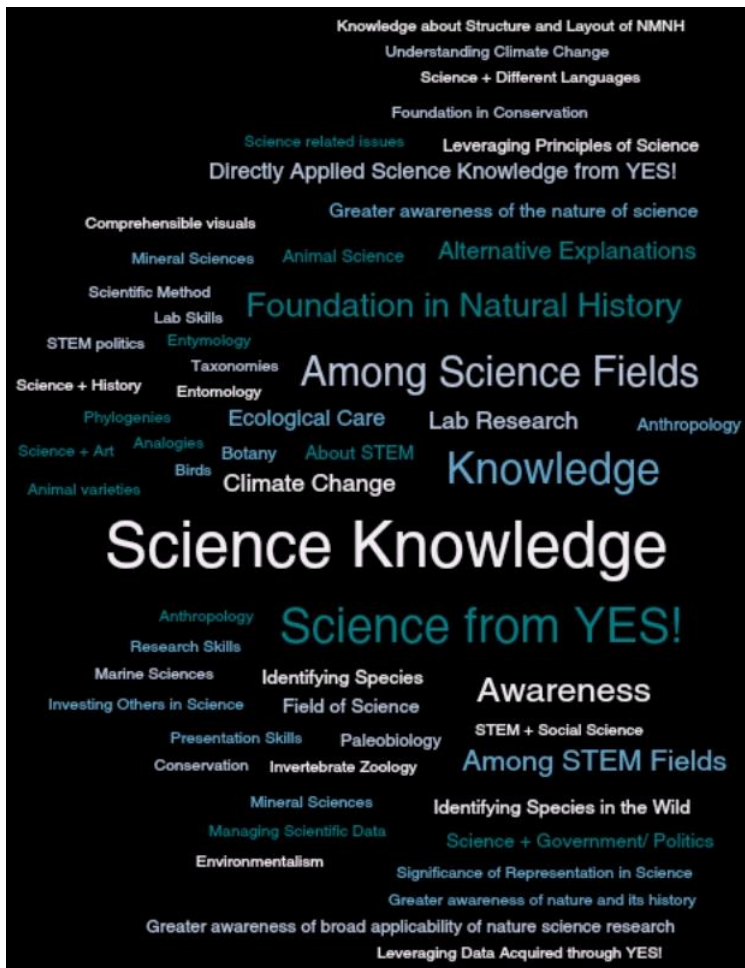


Figure 5. Science knowledge



Figure 6. Personal development

Q1 Outcome 2. Effect on Science Identity, Interest, Study, and Careers

What we learned

- 👍 The YES! program contributed to respondent’s science identity with a lasting effect over time. Almost all (90%) reported a greater integration with science now than before entering the program. Greatest integration was in the areas of interest in the way science can be used to solve problems and how science can be used to help people. Respondents attributed this science interest somewhere between “moderately” and “a lot” to YES!, with most program contribution attributed to their persistent interest in communicating about science.
- 👍 There was also evidence that on the average across all interns including non-respondents, science identity improved.
- 👍 Nearly all responding YES! alums attributed to their YES! internships at least a moderate amount of influence on their choice of college major and/or minor (84%). Of that group, almost half majored in a natural science, one third in a social science and the rest in technology, engineering or math. In some cases, YES! influenced even going to college at all.

The YES! program helped me see college as more of an option for myself so I became more ambitious in my pursuit of college acceptance to 'bigger and better' colleges."



Almost three quarters of respondents had chosen STEM-based career paths. Of this group almost 80% reported at least a moderate YES! effect on their choice.



However, by cohort, the number of respondents pursuing STEM ranged from 87% in the youngest cohort to only 45% in the oldest (among whom 68% had graduated from college with another 19% either attending or planning to return).



Of the oldest cohort (7 to 9 years post high school graduation), 91% had selected a science major; 68% had graduated from college and 45% were pursuing a STEM career at the time of the survey. Across the whole YES! alum population, even if every non-responder had left college before graduating, half would have pursued a STEM major, a third would have graduated, and a quarter would be pursuing a stem career. These numbers compare quite favorably to those of the general population "leaky pipeline" study that showed that of all college ready seniors, one fifth chose stem majors and just over a tenth graduated from college (National Science Board, 2008).



For many interns, YES! created broad exposure to and deeper understanding of science, science disciplines, and science career options. These experiences led to conceptual and attitudinal shifts that helped interns find clarity about academic and career direction or gain more general career awareness and interest. This exposure and understanding emerged from personal relationship to professionals including project mentors; having science educators as role models; the quality of relationships with staff and mentors; having direct workplace experience; and specific YES! program activities such as field trips, lectures, and working with the public.

I conducted a small study during my time at the Zoo. Those experiences prepared me for the greater research I've completed in private companies and other universities since being in college.

How we know

Two areas of inquiry produced evidence of YES! impact on interns' science-related academic and career trajectories. First was to explore changes in their interest in science and how much their YES! experience contributed to it. Second was to assess science involvement in alums' academic and career choices and again, to document how much they believed their YES! experience contributed to those plans.

Science Identity

Analysis of respondents' selection of Venn diagram representation of their pre-YES! and current intersection with science revealed that overall, most alums perceived themselves as either maintaining or strengthening their science identity.

The mean pre-YES! score was 3.49 ($sd=1.5$) and the mean post-score was 5.22 ($sd=1.4$). Figure 7 illustrates pre-YES! and current-scores plotted to show participants' perceived changes in their relationship to science. Only 10 of 99 (10%) reported that their science interest was less now than before their YES! internship. Curiously eight of the 10 with a negative change in science interest reported 70% overlap before their YES! internships. Further, no one who reported 70% overlap before his or her internship stayed at 70% afterward; i.e., eight showed a decline in interest and 12 showed an increase. The largest increase in interest was five steps ($n=2$), followed by four steps ($n=12$), three ($n=18$), two ($n=30$), and one ($n=17$), while only 10 interns reported no change in science interest. The largest decline was four steps ($n=1$), followed by three ($n=2$), two ($n=3$), and one ($n=4$).

Of the ten alums who reported less science identity now than before entering the YES! program, half (5) reported that their YES! experience had influenced their career choice "a moderate amount" within this group, career choices included psychology; marketing consulting; "writer; teacher; and freelance designer/illustrator;" "a licensed social worker with her own practice;" and "an entrepreneur with multiple business ventures to include real-estate and non-profit work." A sixth respondent, one, at the time on leave from veterinary school, reported "a great deal" of YES! influence on career choice. Half of these respondents reported a "great deal" of YES! influence on their engagement with science outside of work or school or school with the remaining half reporting a "moderate amount."

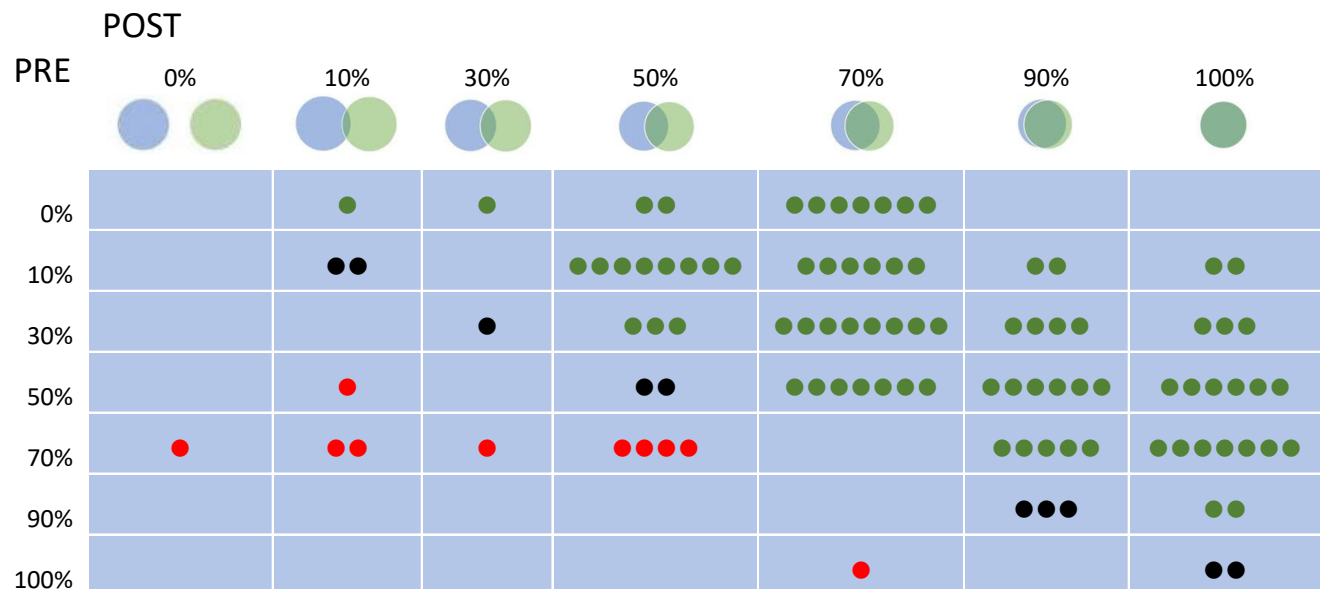


Figure 7. Comparison of YES! alums’ personal identification with science from pre-YES! internship to “now.”

Across all responders, the average pre-program to “now” science identity change was 1.7 with a 95% confidence interval ranging from 1.4 to 2.1. To test how well the finding held among the whole alumni population, assuming a worst-case scenario where all non-responders experienced a loss of science identity, we assigned each a -1.0 value. Even with that negative bias, the average identity change in the whole alumni population was positive (Table 13). There were no differences between male and female groups either among responders ($t=.03$, $df=97$, $p=.98$) or the whole population ($t=1.16$, $df=172$, $p=.24$).

Table 13. Extrapolation of findings to non-responders.

	Total		Female		Male	
	n	mean (c.i.)	n	mean(c.i.)	n	mean (c.i.)
responders	99	1.7 (1.4-2.1)	64	1.7 (1.3-2.1)	35	1.7 (1.2-2.3)
population*	174	.54 (.3-.8)	121	0.4 (0.1-0.8)	53	0.8 (0.3 - 1.3)

* assuming science identity loss of -1.0 for all non-responders

Science Interest

Responses to the science interest scale provided a more detailed view. As shown in Figure 8, greatest personal integration with science occurred in the areas of interest in the way science can be used to solve problems and how science can be used to help people. Respondents attributed this science interest somewhere between “moderately” and “a lot ” to YES!, with most program contribution to their persistent interest in communicating about science.

More specifically, the mean science interest was 4.19 (0.6) and the mean for the YES! contribution was 3.59 (0.8). The range in science identity scores was 3.8 to 4.6 (on a 5 pt. scale) and for contribution scores is 3.3 to 4.1. Incidentally, the lowest reported score for both was “I spend my free time trying to find out more about science or scientific topics.” The highest scoring science identity score was “I am interested in the way science can be used to help people.” The highest scoring contribution score was “Communicating scientific topics to others is interesting to me,” which also had a relatively high score on science identity (4.3). While we reran the analysis for these variables by cohort, we saw no differences between cohorts and are, therefore, reporting the overall results.

Because some interns reported that they did not have certain skills, the contribution analysis includes fewer participants than the overall science identity (n ranged across skill items: 101 to 102; n ranged across contribution items: 66 to 74).

Figure 8. shows the mean science interest in the blue bar and the YES! contribution in the green rectangle. It is sorted from highest to lowest YES! contribution.

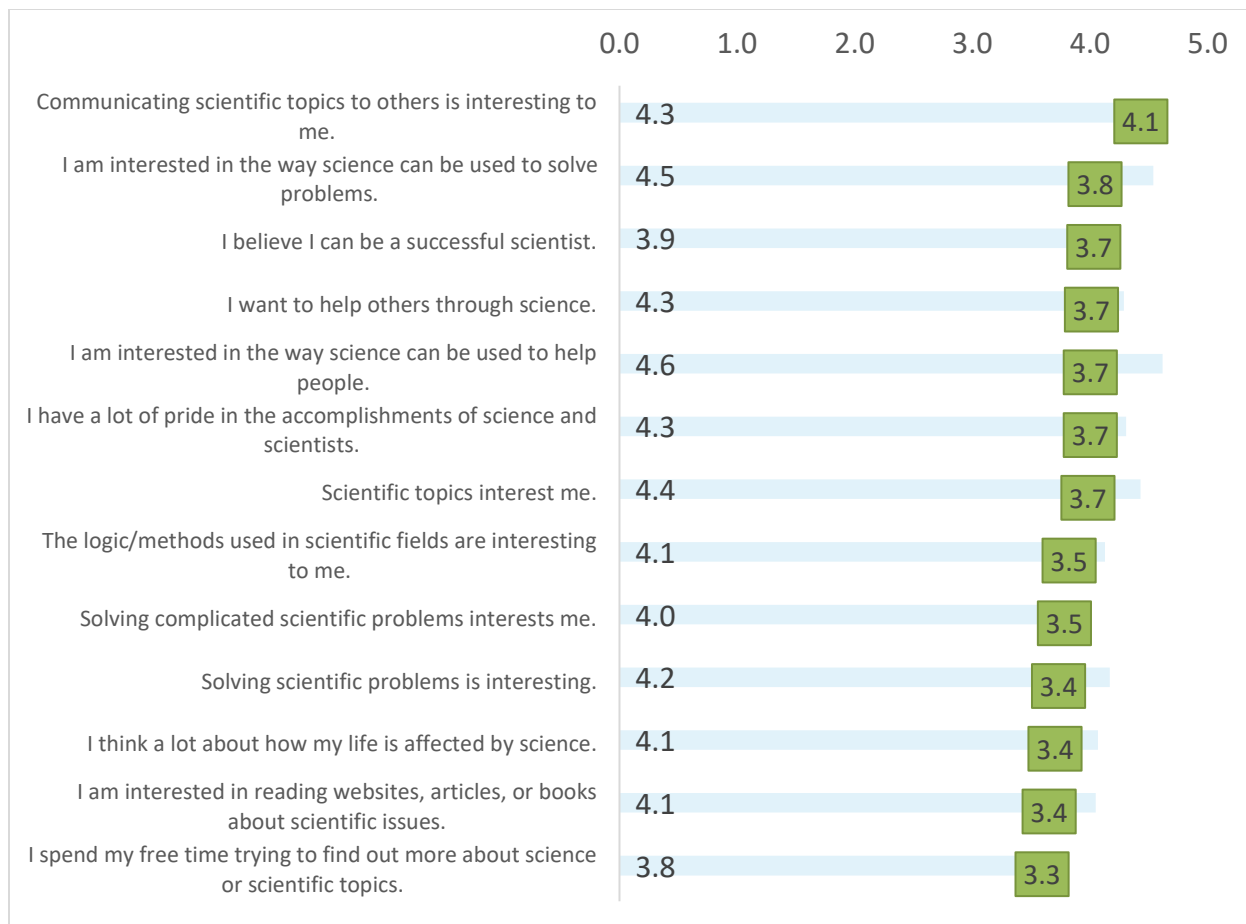


Figure 8. YES! Intern science identity items and YES! contribution scores

Academic Paths

Nearly all YES! alums attributed to their YES! internships a great deal of influence on their choice of college major and/or minor (84%). Only 16 interns indicated a low effect of their internships on their academic paths (16%). Of the high-effect respondents, 43% were interested in majoring and/or minoring in natural science and another 29% in social science. Further, 18% were interested in majoring in technology, engineering or math. Ninety percent of those who reported this high effect, then, elected or are interested in pursuing majors and/or minors in these science-related fields. Additionally, two high-effect respondents (2%) indicated they were interested in medicine/pre-med, four (5%) in business, one (1%) undecided, and the remaining one (1%) other.

There were far fewer low-effect respondents (n=16). Curiously, 88% of these interns were also interested in the same distribution of science-related fields as the majority of high-effect interns.

Table 14 illustrates the choice of major and minor field by participants by high and low effect using the research team's coding structure.

Table 14. Choice of major or minor by high and low effect

	High Effect		Low Effect	
	n	%	n	%
Natural science	36	43%	2	12%
Social science	24	29%	6	38%
TEM (technology, engineering or math)	15	18%	6	38%
Med/pre-med	2	2%	1	1%
Business	4	5%	1	1%
Undecided	1	1%	-	-
Other	1	1%	-	-
TOTAL	83		16	

The experiences of interviewees revealed ways that YES! promoted and affected interest in and motivation for studying science and science careers. They spoke about this effect in four ways: (1) general science interest, (2) high school science pursuits, (3) undergraduate science pursuits, and (4) graduate and/or career science pursuits.

With regards to changes in general science interest, for example, F2 brought up the theme of her passion for science being inextricably linked to her YES! experience. Similarly, M2 spoke of his YES! experience making him a more science-minded citizen; F10, the theme of exposure to science in multiple settings sparking her interest in STEM. F4 opened up about feeling more confident and comfortable in STEM spaces due to YES!. This increase in self-efficacy and sense of belonging within STEM were not unique to F4 and recur in this report in the discussion of outcomes 1.4 and 2.

Regarding pursuing science in high school, the themes of engaging in STEM research and pursuing upper-level STEM classes arose during the interviews. To this end, F1 spoke to pursuing civil engineering / urban planning research abroad in Finland and F4 spoke to pursuing AP level science courses.

At the undergraduate level, interviewees pursued fields of anthropology, chemical engineering, ecology and evolutionary biology, environmental science, mathematics, and research. These people's stories demonstrated how YES! affected academic direction in ways that involved, discovering passion, self-confidence, and focus. F2 and F8 both spoke of "falling in love" with anthropology and choosing it as a major after their YES! exposure to the field, gaining experience, and having the opportunity to gain and applying their knowledge. YES! gave F2 the confidence and sense of self efficacy she needed to pursue chemical engineering, a field with which she was intrigued but had no experience. F4 also spoke of building the self-confidence that led her to pursue an environmental science internship through her college's office of sustainability. YES! helped M1 clarify his specific field of interest within science to pursuing a degree in ecology and evolutionary biology. Likewise, F3's deeper understanding of environmental science motivated her to pursue it as her undergraduate major. Similarly, F6 clarified her intention to minor in mathematics especially after seeing people like her, other Latinas, pursuing STEM. Perhaps summing up what some of the respondents may have meant by "a great deal" of impact was F4's description of learning that anyone can pursue research and that research was accessible--even to her.

In addition to these stories, qualitative responses to open-ended survey questions also provided insight. For some YES! interns, just learning about college itself made a difference. As example, respondents wrote comments like the following:

"I learned about the college application process and what to consider when applying to college. I took the financial implications of my choices very seriously, and began my college experience at [my community college] as a result.

YES! program in general helped me fuel a confidence to think farther than the present and to think of my future. Leading up to the program I remember that I was in the process of thinking about what I want to do after high school, and I wasn't too sure. But there are many programs that I became a part that helped. In that mix, YES! was a big one, and it helped me think of fields that I never thought a person like me could be a part of and in general taught me about fields in STEM that I never really [had been] taught about.

The YES[!] program helped me see college as more of an option for myself so I became more ambitious in my pursuit of college acceptance to 'bigger and better' colleges.

Career Paths

Overall, most alums (73%) had chosen career paths involving the sciences (Table 15). The largest group (30%, mostly female) had chosen the social sciences, which included (in order of most to least frequent): education, psychology, legal, social work, urban planning, public policy, public health, environmentalist, anthropology, civil service, and museology. Most of the remaining were fairly evenly spread between medicine, natural sciences, or as a group, technology, engineering or math. Of the remaining 27%, half had chosen business and the other half other professions (e.g. politics, farming, landscaping, policing) or undecided.

A view by cohort reveals a perhaps predictable pattern where careers in the sciences were less frequent in the older cohorts than in the younger. Of the oldest group of alums, most of whom had graduated from college, only 45% had chosen STEM careers compared to 82% of the largely still-in-college middle cohort and 87% of the youngest.

Table 15. Respondents' reported career path by cohort

Career Type	Cohort (youngest to oldest)							
	Total		2016-18		2013-15		2010-12	
	n	%	n	%	n	%	n	%
Social Science	29	30%	8	27%	17	45%	4	14%
Med/Pre-Med	15	16%	9	30%	4	11%	2	7%
Natural Science	14	14%	6	20%	4	11%	4	14%
TEM (technology, engineering, or math)	12	12%	3	10%	6	16%	3	10%

Business	12	12%	1	3%	6	16%	5	17%
Undecided	8	8%	2	7%	1	3%	5	17%
Other	7	7%	1	3%	0	0%	6	21%
Total STEM-related		73%		87%		82%		45%

Table 16. Respondents' reported career path by gender

	Female		Male	
	n	%	n	%
Natural Science	7	11%	7	21%
Social Science	24	38%	5	15%
TEM (technology, engineering, or math)	6	10%	6	18%
Med/Pre-Med	9	14%	6	18%
Other	4	6%	3	9%
Undecided	5	8%	3	9%
Business	8	13%	4	12%

Three quarters of respondents reported a high program effect on their career choice (Of the oldest cohort (7 to 9 years post high school graduation), 91% had selected a science major; 68% had graduated from college and 45% were pursuing a STEM career at the time of the survey. Across the whole YES! alum population, even if every non-responder had left college before graduating, half would have pursued a STEM major, a third would have graduated, and a quarter would be pursuing a stem career. These numbers compare quite favorably to those of the general population “leaky pipeline” study that showed that of all college ready seniors, one fifth chose stem majors and just over a tenth graduated from college (National Science Board, 2008).

Table 17.) Among alums who perceived a high program effect, 75% had chosen a STEM career. Among the 70 respondents pursuing STEM careers, 79% had reported a high program effect on their choice.

Of the oldest cohort (7 to 9 years post high school graduation), 91% had selected a science major; 68% had graduated from college and 45% were pursuing a STEM career at the time of the survey. Across the whole YES! alum population, even if every non-responder had left college before graduating, half would have pursued a STEM major, a third would have graduated, and a quarter would be pursuing a stem career. These numbers compare quite favorably to those of the general population “leaky pipeline” study that showed that of all college ready seniors, one fifth chose stem majors and just over a tenth graduated from college (National Science Board, 2008).

Table 17. Career choice by high and low effect

	High Effect		Low Effect	
	n	%	n	%
Social Science	25	34%	4	17%
Med/Pre-Med	10	14%	5	22%
Natural Science	14	19%	0	0%
TEM (technology, engineering, or	6	8%	6	26%
Total STEM-Related	55	75%	15	65%
Business	10	14%	2	9%
Undecided	6	8%	2	9%
Other	2	3%	4	17%
TOTAL	73	100%	23	100%

How YES! influenced academic and career paths.

Interviews and qualitative questionnaire responses reflected the quantitative findings about YES! influence on STEM academic and career paths. Alums described this influence as coming from experiences that created broad exposure to and deeper understanding of science and science disciplines, and science career options. These experiences led to conceptual and attitudinal shifts that helped them find clarity about academic and career direction or gain more general career awareness and interest. They attributed this exposure and understanding to various sources including personal relationships to professionals including their project mentors; having science educators as role models; the quality of relationships with staff and mentors; having direct workplace experience; and specific YES! program activities such as field trips, lectures, and working with the public.

Broad exposure and deeper understanding.

YES! influenced career paths by opening up greater understanding of the nature of science and variety of science fields, career exposure, gaining work experience, and realizing the wealth of STEM opportunities in the DC area. For example, one alum wrote:

YES! not only made me more confident as a woman in the sciences but also taught me so much about all the different scientific fields and possibilities for jobs in those fields. This program helped to push me to think about careers and try to further narrow down what I was interested in and hoped to do one day."

The interviews revealed similar experiences. F3's new understanding of lab work and scientists led to her intention to pursue a career as an environmentalist. F9's new understanding of research led to her intention to pursue a joint MD and PhD. Both of these alums, along with M1, who at the time of his interview was pursuing a PhD in Tropical Ecology, and F5, who was aiming to pursue a career in science, all spoke to the effect of their YES! experience of getting to see firsthand what a career in their respective fields looked like.

Respondents credited a variety of sources for this heightened sense of career clarity, ranging from the people associated with the program to the science content and its application. Sometimes this new understanding came through exposure to professionals or through a project mentor.

For example, one alum seeking to be lawyer/lobbyist wrote “*My mentor opened up new opportunities when they took me to Capital Hill and introduced me to the government aspect through STEM.*” Another wrote:

It helped me figure out what science field I saw myself actually working in day after day. Being exposed to various researchers through tours, talks, and intern activities really showed me what I did and didn't want for myself.”

More generally, respondents noted exposure as affecting their career development, sparking and molding their interests that later morphed into fields of study, career aspirations, and in this case, even providing a similar opportunity to others:

“The YES! Program exposed me to many STEM Fields, and also many college related topics. Exposing me to an environment I never really thought that I would be a part of. My friend enjoyed the program so much and it helped me realize that I wanted to have the same impact on youth someday, as the YES! Program had on me and my friends.”

Conceptual and attitudinal shifts.

Alums often wrote about this exposure and understanding as leading them to new perspectives on future pursuits, as in the following quotes:

Participating in YES! had a profound effect on me when I chose my college major. I had a closer look at all the sciences I was already interested in and found out what I wanted to focus on in my higher education.”

Getting exposure to insects solidified my ambition to pursue a path in entomology. I couldn't find an in state university that offered it as a major, but I found it as a minor and picked a major that I felt had relevant applications in entomology.

Meeting with scholars from different fields who worked in the Museum of Natural History definitely inspired me to follow my passions. I was always interested in the environment and having the opportunity to explore this passion while in the YES! program led me to pursuing environmental studies at Davidson.

Descriptions such as these revealed that opportunities for broad exposure and deeper understanding led to important conceptual and attitudinal shifts. These shifts included: gaining a clearer understanding of the nature of science and the interdisciplinary nature of different academic disciplines; focusing from broad science interest to interest in a specific discipline; broadening awareness of the range of academic topics and pursuits; instilling a greater sense of academic awareness; sparking a new interest; strengthening and solidifying a pre-existing interest; realizing the applicability of science to everyday life.

These conceptual shifts, derived from interdisciplinary associations they had made during their internships, also played prominent and varied roles in academic and career decisions. As shown in

the following quotes, they could lead to general appreciation and interest; specific interest (e.g. the broad application of biology); understanding the cross-discipline applicability of a specific interest (e.g., math); transfer of skills or interest to a different discipline (e.g., natural history research to psychology); integration of science with business and technology; The following quotes provide examples:

YES helped me begin to establish my love for the science and opened my eyes to just how interdisciplinary science is.

I had not planned on doing a biology major when I first entered college. I reflected back on the experience I had in the YES! program, specifically speaking to different scientists and their research, and realized that there is so much to do in biology.

I interned at both NMNH in the Mineral Sciences Department and NASM in their public observatory, and loved both museum environments. I mentioned to all my mentors I had planned on majoring in mathematics, and they all kindly and enthusiastically showed me the relevance of math in their day to day jobs. That, in one form or another, encouraged me to move forward with my original plan of studying math. As for my Russian & Post Soviet major, the Soviet Union practiced, and the Russian Federation today continue to practice, space travel. Throughout my time in NASM, it was extremely common to find an article or artifact with Russian Cyrillic on it, etc. So I picked up the major because it seemed relevant to my interests.

It made me passionate about science and opened my eyes to what a career in this field could look like. I am currently doing psychology research at my institution and if I hadn't done research in a lab at my time in YES I'm not sure I would have felt confident enough to pursue the research I'm currently doing. YES pushed me out of my comfort zone and showed me how science plays a role in so many different fields of study.

I am currently planning on pursuing an integrated science, business, and technology minor. This minor interested me because I saw through my internship that these fields are constantly working together. From the trash lecture to the electron microscope to even recording with DCTV, I saw how these fields interacted constantly. While having this program as a major would not work with the graduate degree path that I am following, I still am interested in pursuing it as my minor because I believe that it will improve my ability to function in working society and my knowledge of all of these fields.

An additional conceptual/ attitudinal shift illustrated in these responses was a changed sense of self efficacy, which we discuss more fully in section 1.4. This shift, however, is significant as respondents reported this shift propelling them towards pursuing studying science and science careers.

Relationships with Professionals.

Not surprisingly individual relationships made a difference. Both F2, who hopes to pursue an MD/PhD in Anthropology and M3, who is pursuing an MA in Medical Illustration spoke of being influenced by professionals they met through YES!. Both F10, who was aiming to pursue a career in

STEM education, and M3 spoke of being inspired by YES! science educator role models to pursue graduate level education and careers in STEM education.

Written responses echoed this concept of the impact of professionals both in their individual projects and within the program itself. In particular, having scientist role models provided a better understanding of the work they do. Providing alums with a vision of themselves in that working environment served as a motivation for alums to further pursue a science related career.

In some cases, impact came from exposure to a wide variety of professionals. For instance, one alum wrote:

It encouraged me to pursue a medical career even though it is very hard path to pursue because during YES, I met so many talented and passionate professionals who genuinely seemed happy about their career and worked hard to get there. Which inspired me to pursue a career I love even if the journey will be extremely hard.

Sometimes the relationships alone made the difference. Unlike F10 and M3 who described the influence of YES! staff as role models, one respondent's comment highlighted the importance of the quality of the relationship itself:

"I will always attribute a great part of my science development and passion to the YES! program. Those two summers I spent with the warm, caring, and understanding YES! staff were pivotal to my successful youth. Being exposed to science in such an amazingly pleasant way, early in my career was what ultimately led me to pursue a double major in Chemical Engineering and Anthropology. I could write an extensive piece about how YES! literally changed my life for the better, but I am time-restricted write now. lol Honestly, if I had unlimited time and extensive elective space, I would take more courses in topics related to natural history at school. I will always be fond of the YES program. There is a warm and bubbly place in my heart for YES and NMNH in general. This place/experience made me fall in love with science more deeply."

Professional workplace experience.

The opportunity to experience a professional workplace also influenced career choice, and more specifically, excelling professionally by applying learned skills, pursuing graduate education and forming a career vision. As examples, respondents wrote:

I conducted a small study during my time at the Zoo. Those experiences prepared me for the greater research I've completed in private companies and other universities since being in college.

...the YES! program furthered my understanding of responsibility, perception, and patience. I used this during my job as a Rec PAC counselor this summer, where these skills were incredibly useful."

YES! Program activities.

Alums named programs and lectures, experience working with the public, field trips, behind the scenes tours, and science communication training as events that produced this sense of exposure

and understanding. The following quote shows how a single activity can provide the exposure that helps focus a career interest.

Before the YES! program, specifically the field trip to SCBI, I did not know that there were science occupations, other than zoo-keeping, that involved lots of hands on work with animals and the problems that face them in their struggles for survival. I realized that conservation science is something in which I am very interested in and I will be able to combine this new interest with my interest in marine biology and study marine conservation.

Q1 Outcome 3. Science Communication

What we learned

Just over half of the responding Alums valued their YES! experience for having contributed to their ability to utilize good science communication skills. On average respondents rated as moderate both their communication skill use and YES! contribution to their ability to use those skills. Half of the respondents were, on the average, using the skills at least moderately and also, at least moderately attributed to YES! their ability to do so.

Alums used these skills academically, in the workplace, and outside of work or school. At school, they used them to communicate research and disseminate information.

In work settings they used their YES! communication skills for public speaking, explaining ideas, thoughts, and opinions, translating science concepts to those in other fields, formal presentations, scientific writing,

Outside of work, they described using their skills for climate change advocacy, career access to under-represented groups and for modulating explanations to be sensitive to the needs of differing audiences.

How we know

The mean communication skill use was 3.3 (sd=1.0) and the mean for the YES! contribution also was 3.3 (0.9). Fewer people provided responses for how much they currently use skills than for how much the YES! internship contributed. Perhaps, regardless of whether they use these particular skills, alums credit the YES! program with contributing to their ability to use them. A closer look revealed that approximately half of the respondents (50 of 97) averaged moderate to high use with moderate to high contribution. The remaining half (n=47) was evenly split between high use and low contribution; low use but high contribution, and low use and low contribution.

However, the range of the number of respondents who answered each “ability to use” item ranged from 66 at the fewest to 79 at the most; the number who answered each contribution item ranged from 91 at the fewest to 98 at the most. Perhaps, regardless of whether these alums were using these particular skills, they credited the YES! program with contributing to their ability to use them.

Figure 9 illustrates responses by item. Science communication use scores ranged from 2.5 to 4.2. The two most used skills involved techniques for direct verbal interaction, i.e., “Listening patiently while someone finishes asking a question (even if I already know what they’re asking before they’re finished),” and “Asking a listener if they understood my explanations.” The three items ranked as least used described using objects and educational aids (e.g., maps, graphs, specimens). Interestingly, the highest rated contribution score was for “Linking multiple objects or specimens to help listeners understand my explanation,” the second-lowest use score. The contribution range was 3.0 to 3.8, which is similar to but slightly lower than the science identity contribution scores.

Figure 9 shows the mean communication skill in blue and the YES! contribution in green.

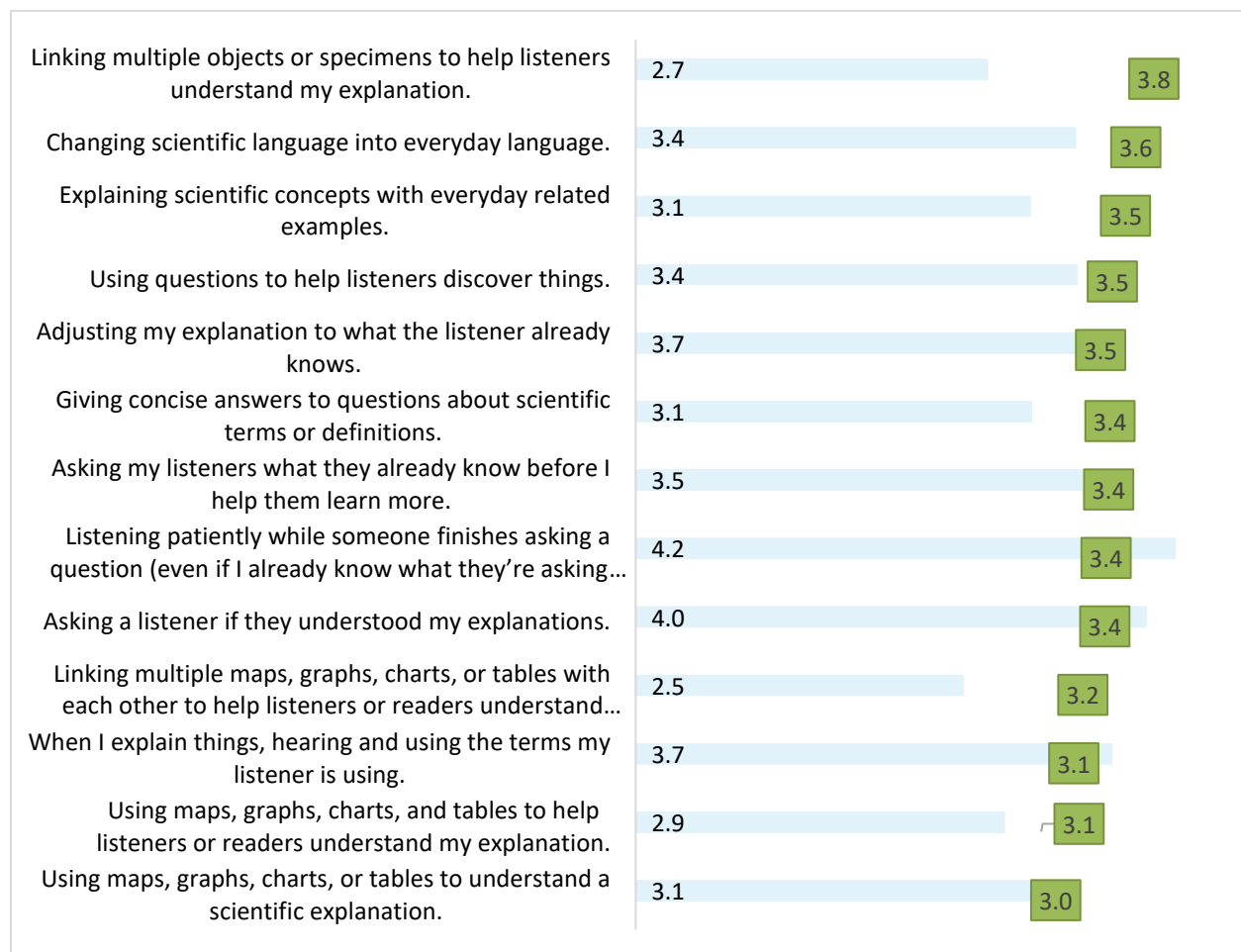


Figure 9. Science communication skills and the YES! contribution to scores.

Additionally, analyses for differences by either cohort or gender revealed no significant differences.

Interviews and written qualitative responses provided further insight into these findings. The 13 alums who participated in interviews, demonstrated the application of their science communication skills professionally, academically, and as science educators. F4 spoke about relying on her YES! science communication skills for job interviews in environmental science, a field that demands excellent communication skills for tasks such as explaining climate change to the public. She

described continued use of those science communication skills in her job at Climate Reality. F3, an environmental science undergraduate, spoke of applying her science communication skills academically when communicating with professors and peers at college. After receiving a grant from the Bezos Family Foundation, M1 used his science communication skills to become a science educator in his community. Similarly, M3, a graduate student in medical illustration, used the confidence his science communications skills gave him to become a science educator. F9 continued her YES! “Reach 100” beyond the 100 person target, taking her STEM outreach presentation to local elementary schools.

F4 used their science communication skills for communicating about his YES! research. F9 spoke of casually communicating fun science facts both in academic settings and with friends. And F5 was using her skills for reducing barriers to STEM access among women through starting a nonprofit that exposes minority women to STEM.

Similarly, questionnaire respondents wrote about using science communication for both informal and formal teaching, simplifying concepts, science outreach, and communicating about climate change. Regarding science outreach, one respondent said, “I do a lot of women in technology/STEM outreach work and use my communication skills to organize events, panels, and talk to the public.”

They also wrote about using their communication skills academically—for communicating research and disseminating information. In work settings they used their YES! communication skills for public speaking, explaining ideas, thoughts, and opinions, translating science concepts to those in other fields, formal presentations, and scientific writing. Some representative examples include:

I gained communication skills during my internship. Before YES!, I was timid and now I love public speaking. Definitely useful for interviews and presenting new ideas to my team at work.”

“I work in the tech field and I constantly have to understand what developers are telling me and translate it into things others without that background will understand. I also have to be able to communicate to developers what designs will be needed.”

When respondents wrote about using their YES! communication skills outside of work, for such purposes as climate change advocacy and, as in the following quote, for modulating explanations for different audiences:

I learned how to explain and divulge information to different levels of learners--from those who want high level to those who want every detail and how to recognize them.”

Q1 Outcome 4. 21st Century Skills

What we learned

On the average, older alums credited YES! with contributing more than “a lot” to their leadership skills and sense of environmental stewardship.

Alums from the most recent cohorts attributed these attributes just less than “a lot” to YES!

Alums wrote and spoke of the breadth and depth of skills gained that will better serve them functioning in today’s world. 21st century skills, those most frequently represented by alums were communication & collaboration, initiative & self- direction, and critical thinking.

Despite the leadership skill results noted above, alums less frequently referenced them, or for that matter, social literacy skills. However general references to them were subsumed in broader skills categories.

How we know

The mean perceived YES! contribution to participants’ perceived leadership skills and sense of self was 4.23 (sd=0.7). Figure 10 illustrates the specific items in order of the average amount respondents perceived that YES! contributed to their skill (numbers in blue show confidence intervals around the mean). Items referencing Environmental Responsibility ranked among the highest scores. Leadership item averages range from 3.8 to 4.4. Overall, then, respondents indicated that being YES! interns contributed in a major way to their leadership skills and sense of self.



Figure 10. Contribution to leadership skills and sense of self confidence intervals around the per item means.

We also ran these analyses by cohort and found that, while the first two cohorts were similar, the 2016-18 cohort rated the YES! contribution lower than their predecessors as seen in Table 18.

Table 18. YES! contribution to leadership skills and sense of self by cohort

	Mean
2010-12	4.44
2013-15	4.34
2016-18	3.90

Table 19 shows the YES! contribution to leadership skills and sense of self by cohort for each item in the section. The 2016-18 cohort is lower on each of the 11 items. Aside from the item, “Ability to be patient,” where the rating progressively decreases across cohorts, the 2010-12 and 2013-15 cohorts have similar ratings across the items.

Table 19. YES! contribution to leadership skills and sense of self by cohort and item

	2010-12	2013-15	2016-18
Interact adults	4.52	4.26	3.73
Actions affect	4.03	4.00	3.42
Tell what learned	4.68	4.53	4.06
Work in group	4.61	4.50	3.76
Share thoughts	4.42	4.45	4.15
Be patient	4.35	3.97	3.58
Try new things	4.39	4.53	4.12
Accept responsibility	4.42	4.42	3.82
Leadership role	4.26	4.26	3.91
Care of environment	4.58	4.50	4.21

This finding of differences between cohort groups deserves further consideration. One explanation may be that YES! participants were given less leadership opportunity in recent years. An alternative explanation could be that distance from the experience creates a different perspective.

Qualitative responses and interviews provided a rich understanding of how YES! affected 21st century skills (as defined by Batelle for Kids, 2008 and illustrated in Figure 2 above). Responses revealed that interns seldom acquired these skills in a silo. Generally, they reported gaining, even from one experience, several interrelated skills across the 21st century skills spectrum. For example, one respondent wrote:

Another skill was work etiquette-- being timely, responsible, and kind. I understand these are all basic things, but at the time I participated in this internship, YES! had been my first "work" experience. This internship allowed me to practice timeliness in a professional setting, which is without a doubt imperative because no one likes a late person. Another skill was adaptation because YES! exposed me to a completely new work environment. I come from a low-income family, where honestly no one works at an office, not to mention a museum. Most jobs my friends and family had (at the time I completed the internship) had all been in fields like construction, cleaning, fast food

business, store associates, etc. No one had a desk or a plaque with their names on them like my mentors. This new setting helped me immerse into new opportunities and imagine myself in their shoes. This adaptation mentality has helped me gain opportunity in areas I would have never imagined myself in before; interning at Gallup, the U.S Senate, and studying in Russia, etc. Adapting to new environments is key, and YES! was my first experience into practicing this skill.

The myriad of skills gained here fit within multiple 21st century skill including professionalism, critical thinking, conceptual/ attitudinal shifts, and adaptability. Interview stories also illustrated how gaining 21st century skills wasn't limited to developing a predetermined set. Recognizing that these skills tend to co-occur, three categories were more strongly represented among the responses: Communication, Initiative & Self- Direction, and Critical Thinking Skills.

Communication & Collaboration. Communication was the most frequently referenced 21st century skill-- though communication more often than not coupled with life and career skills. Each individual reported going through different experiences and growing professionally and personally in their own unique way.

Concerning communication, M3, F10, F8, M1, F4, and F5 all spoke of the YES! impact on building their communication skills. F10, M3, and F5 explicitly spoke about their shyness during their interviews and how they grew through gaining science communication experience. Through opportunities to engage visitors in talking about their science research, each practiced their presentation skills and practiced communicating complex topics with museum visitors. At the time of their interviews, each was using their YES!-acquired communication skills. F10 was pursuing a career through which she has the opportunity to teach science in a classroom; M3 had experienced a shift in perspective and was perceiving himself as an educator and communicator through his art; and F5 was using her communication skills on a daily basis at work making calls and participating in meetings.

While several alums spoke of continuing to use science communication skills explicitly (see Outcome 3 science communication), many of the interviewees' stories demonstrated that science communication was a transferable skill. Their experience communicating science to museum visitors during their internship transferred to various realms of their life and helped them communicate a variety of messages in a variety of disciplines and fields. F10 and F4 noted that they felt more comfortable in settings where they were responsible for communicating messages to a group of people. Both F10 and F5 used these communication skills, in the workplace. Other alums wrote about using their communication skills academically. For example, one wrote:

Public speaking and analysis skills that I learned from YES! have been key to my success in college! I have been able to become a better problem solver and put this into my research and classes!"

Another used communications skills more personally: *Talking to people and asking them about their paths as people.*

Alums also wrote about using communication skills for such purposes as communicating about the self in a professional manner, disseminating information, explaining ideas and opinions, adjusting speaking style and content to different audiences, presentations, and simplifying concepts or translating.

Responses such as the following demonstrated how this transfer took place.

The outreach experience [disseminating information and presentations] has been really helpful in carrying out my own nature walks and talks about insects/plants with school groups. I had (and still struggle a little) with stage shyness but YES forced me to confront that for the first time in the context of something I was passionate about.

In my work, whenever I present on science topics or need to discuss any complex topic, I always rely on my science communication skills to help others understand topics in either sustainability or composting.

Before entering graduate school, I was a medical scribe at my local community hospital where I had to balance time management, teamwork, and self-management to chart patient medical information in the emergency department. Working alongside doctors and interacting with patients was synonymous to working with an NMNH researcher and educating the general public.

I use those skills when I speak to anyone about anything I am trying to get them to understand. The YES program taught me how to communicate with people differently based on age and other aspects about who they are.

One specific trend within the communication umbrella that alums also brought up was working collaboratively or as part of a team. F4 shared during her interview that YES! helped her realize that she enjoyed and worked well in a collaborative environment. For her, this experience helped her not only develop skills but also realize where her strengths lay. Others mentioned that working in a collaborative environment helped them in future academic and career environments:

Working as a team was a big part of the YES! Program whether it was something small or big. That helped me... understand what everyone in school was able to bring to the table for the group projects, so we don't accidentally give someone too much work.

Team building and partnership is a useful knowledge I learned during my time on fieldwork with one other YES! intern. This was applied in every situation for work and career planning to grow as a member of the community while strengthening the community.

Initiative and Self Direction. Respondents also demonstrated YES!' influence on initiative and self-direction especially in regards to having the confidence to pursue higher levels of STEM related opportunities. This theme is pervasive throughout the qualitative responses and the interviews and manifests itself on professional, academic, and personal levels. One alum wrote that: It helped give

me the confidence to want to do more with my life. The program itself taught me that opportunities can be pursued at any age.

F9, F2, and F3 all discussed the impact of YES! on their belief in their own ability to pursue more science related fields of study in college and career paths. For example, F3 during her interview noted that she grew to know what she wanted to do and how to go about doing it. While this heightened sense of self-efficacy served as a powerful motivator for several of the interviewees, an increased drive or passion related to STEM served to motivate others.

Themes that arose addressing self-efficacy regarding academic trajectories in the qualitative responses ranged in describing the process for selecting colleges to a greater sense of direction in selecting a field of study:

The YES program helped me see college as more of an option for myself so I became more ambitious in my pursuit of college acceptance to "bigger and better" colleges.

It made me passionate about science and opened my eyes to what a career in this field could look like. I am currently doing psychology research at my institution and if I hadn't done research in a lab at my time in YES I'm not sure I would have felt confident enough to pursue the research I'm currently doing. YES pushed me out of my comfort zone and showed me how science plays a role in so many different fields of study.

The YES! Program made me feel confident about my experience and abilities related to natural science. Working in the natural history museum exposes me to many different fields of biology and made me realize that it would be an interesting and rewarding field to study.

During the interviews, both F4 and F1 spoke about how YES! propelled them to seek out more opportunities. While neither of them pursued natural history specific fields of work, both were able to apply the skills and confidence that they had gained through their YES! internship towards applying and pursuing opportunities in technology and government affairs.

Additionally, other alums such as F3 and F6 also talked about how that shift impacted them personally as well. One mentioned that: *It gave me a good voice. I was able to confidently speak about stuff I knew that I was able to. Prior to step I was nervous about speaking to strangers about academics but YES helped me realize that I can and shouldn't be afraid to.*

M2 credited the people around him during his YES! internship-- his cohort members and museum scientists--to instilling and strongly influencing his motivation to apply himself and pursue more opportunities. F1 also demonstrated a heightened sense of motivation after her YES! internship, moving on to seek out and apply for a myriad of diverse opportunities, including but not limited to coding, starting a nonprofit, and seeking out international internship opportunities. She says that this was due in part to a desire to keep building after interning at the Smithsonian, thus the YES!

internship served as an initial stepping stone that led her to her current career. This heightened sense of self efficacy and sense of direction gained through the YES! experience served as a stepping stone, helping alums in moving forward.

Outside of school and work the YES! Program in general helped me fuel a confidence to think farther than the present and to think of my future. Leading up to the program I remember that I was in the process of thinking about what I want to do after high school, and I wasn't to sure. But there are many program that I became a part that helped. In that mix, YES! was a big one, and it helped me think of fields that I never thought a person like me could be a part of and in general taught me about fields in STEM that I never really taught about.

Critical Thinking. Responses revealed that many alums evaluated and reflected upon their YES! experience to analyze its impact on their life, perceptions, or thought process. The most prevalent themes within critical thinking that appeared in the responses were problem solving and analytical skills.

Many of the interviewees noted a change in perception of who it is that actually does science. Through participating in the internship, the alums noted that they came to the realization that scientists could be teens, women, Latina, or even themselves. One interviewee, F9, noted that scientists don't come in molds, anyone can do science.

While many of the interviewees- such as F10, F9, F2, F3, F7, F5, and F4-noted a change in perception of who could be a scientist, many also noted change in how they perceived themselves, their interests, and discovering their own place. While some alums' perspective shifted to seeing themselves as a scientist, M3's perspective on himself shifted to seeing himself as an educator; F4 reported that through her YES! experience she came to a better understanding of what her talents were and what she was interested in doing in a professional realm; and F6 through her experience was able to see people similar to her within the field and feel more confident as a Latina, having a place in the museum. Similar changes in perception are represented in the qualitative data:

It helped give me the confidence to want to do more with my life. The program itself taught me that opportunities can be pursued at any age.

It made me passionate about science and opened my eyes to what a career in this field could look like. I am currently doing psychology research at my institution and if I hadn't done research in a lab at my time in YES I'm not sure I would have felt confident enough to pursue the research I'm currently doing. YES pushed me out of my comfort zone and showed me how science plays a role in so many different fields of study.

YES believed in me and propelled me to believe in myself more profoundly.

Several others indicated that their YES! experience impacted their thought processes. M2 demonstrated in his interview that his experiences impacted his way of thinking about things so that they fit a more scientific method. Another response said that *I learned what it meant to pull information together and build connections between what I learned in science classes and what I learned during the internship.*

Others more specifically mentioned the impact of YES! on their problem-solving capacity.

YES! encouraged me to use critical thinking skills when solving scientific problems and issues. I used this mode of thinking in each of my STEM classes at Cornell, and in graduate school.

Public speaking and analysis skills that I learned from YES! have been key to my success in college! I have been able to become a better problem solver and put this into my research and classes!

Categories that came up in the results but weren't as prevalent were leadership and responsibility and social literacy. While these skills may not have been exhibited as frequently in the results, the examples that were given did illustrate examples of strong leadership capacity and social growth.

Leadership. Several of the interviewees also demonstrated a heightened sense of leadership and ability to take initiative particularly in effort to fill perceived gaps. Specifically, F7 and F5 saw a gap in female representation and STEM careers. With that concern they worked together to found and build a nonprofit that was focused on providing opportunity for girls interested in STEM related careers and political activism.

Leadership and political activism were also demonstrated by F10 as she mentioned that learning more about climate change through field trips and through scientist discussions propelled her towards taking on a role in political activism. She also demonstrated an interest in filling perceived gaps specifically she has seen and taking initiative in filling a gap in science education accessibility in order to make sure that students have access to activities she was able to take advantage of. A desire to similarly impact students was indicated by another alum who wrote that:

The YES! Program exposed me to many STEM Fields, and also many college related topics. Exposing me to an environment I never really thought that I would be a part of. My friend enjoyed the program so much and it helped me realize that I wanted to have the same impact on youth someday, as the YES! Program had on me and my friends.

Social Literacy. The theme of relating to others or social literacy also arose through several of the interviews. While some of the interns connected to each other through their knowledge about different content areas (F2), others would relate to each other due to differences and similarities in their backgrounds (F6), spending time together over the weekend (F6), and by bonding just from spending a significant amount of time together (M2).

Q1 Outcome 5. Network Building

What We Learned

“I have learned that there are people out there who are willing to help you achieve your dreams. I have learned to reach out, be open to new adventures/challenges, and asked for help.” – a questionnaire respondent

Many YES! alums left the program understanding the power of networking. Two success story interviews involved utilizing the YES! network itself – one to utilize cohort colleagues as exhibit explainers at a science festival; another to use both colleagues and mentors to further the efforts of starting and fulfilling the purpose of not-for-profit organization that assists and encourages young women to enter the sciences.

Written references to networking described it as a well-appreciated skill acquired through YES! and applied academically, in careers, and beyond school and work. Academically, alums used networking skills to connect with teachers, mentors, and professionals. They also wrote about valuing their networking skills to get job interviews and valuing networking knowledge as a marketable job skill in and of itself. Some alums wrote about using networking skills outside of school and work some to locate and connect socially or politically with others with similar science interests.

One of the YES! intended outcomes was for YES! interns to build both professional and peer networks. Three success stories from the interviewed alums demonstrated the type of success this intended outcome was meant to generate. When M1 received his Bezos Family Foundation grant he recruited YES! peers to attend and run exhibitions for the kids. Where better to find people who could replicate hands-on informal science learning experiences?

Similarly, when F5 started her nonprofit organization to support young women entering the sciences, she turned to her YES! mentors for support and to YES! peers, including F7, to help out. Moreover, YES! mentors spoke at her events and took on mentorship roles for participants of the program. As part of her YES! take-away knowledge: there is always a support network available to help you get where you want to in life.

F1 told a third network story. After participating in YES!, F1 became involved with creating professional and peer support networks for women in technology.

While existing among these stories of alums who most benefitted from YES!, reference to creating networks among YES! interns, staff or professionals, appeared less frequently in the written responses from other alums. There were, however, frequent references to learning about and applying networking skills academically, in careers, and beyond school and work. Academically alums wrote about “creating professional and interpersonal relationships with our teachers/mentors; the ability to network with STEM professionals that I picked up during my time in YES! helped me do the same in professional settings during undergrad.”

Career-wise, alums wrote about their appreciation for learning about networking, creating support networks, using networks to find jobs. Beyond school and work, alums used YES! acquired networking skills to create a support group; and to find and connect with others who share similar science interests.

Factors that Enhanced Outcome Achievement and Barriers to Achieving Them

When respondents were asked what other conditions in their lives affected the impact of their YES! experience, the three most common responses were regarding standing interests and/or experiences, their personal lives, and those involved in YES!

Those who indicated that their standing interests and experience affected the impact of their YES! experience wrote about standing interests in STEM, history, nature, experiences volunteering at the Glen Echo Park Aquarium, working at NMNH, and not having alternative outlets for scientific work.

Respondents also wrote about how additional support affected the impact of their YES! experience. These supports included supportive SI scientists, getting to work with a YES! researcher after YES!, having an extra mentor, supportive family, supportive friends, and having a teacher endorse YES!.

On the other hand, some respondents wrote about structural, circumstantial, and personal conditions that functioned as barriers. These included academic stress, college, being under-represented in STEM, commuting challenges with transportation and the location of NMNH, time constraints from having other jobs, the heat, and this being their first internship experience. Barriers also included personal life circumstances: health issues, their family situation, their family's financial situation, their living situation, and having no family with STEM connections.

Results Q2. Contribution to additional longer-term outcomes

What We Learned

I am still very passionate about science. I volunteer with Bernie Sanders and his plan to combat climate change, a topic I learned a lot about at the NMNH. A lot of my artwork is about natural science. I like to learn about the subjects of my paintings which are usually plants, animals and people.

Outside of school or work, more than two thirds of the responding YES! alums engaged in at least one type of STEM-related activity. Most frequently the activities involved hobbies or volunteering, and slightly less so, for political activism.

Across each of the activity types, most all participants in that activity reported a moderate to high contribution of their YES! experience. However, overall, less than half of all the respondents reported a moderate to high YES! influence on their participation in any one activity.

YES! alums experienced beyond-intended outcomes that could be categorized as involving awareness; conceptual/attitudinal shifts; interests or involvement; personal development;

NMNH/Smithsonian involvement; personal development; or what can be considered “stepping stone,” i.e., indirect contribution to an outcome achieved in a different experience. Respondents often ascribed these outcomes to the program, the people in the program, to conceptual shifts in thinking or understanding, or to the project in general.

The program made me more comfortable with small talk and public speaking, so I gained confidence in my ability to move in circles that I wouldn't necessarily "fit" in.

Among the alums who benefitted most (as represented by the interviews) frequently occurring beyond-intended outcomes included transferrable skills (e.g., science to art), an awareness of or interest in combatting barriers to STEM accessibility, and finally alum development of a stepping stone experience.

Even though I don't currently plan on working in the field of science I have learned professional skills and how to communicate that will help me in my field of Law.

I decided I would want to explore forever and explore ways to better lives (not exactly through natural science) but using my interests in psychology and research to eliminate workplace abuse and toxicity.

How we Know

Approximately half of the responding YES! alums used their STEM learning outside of school and work. Approximately half of the respondents reported hobbies and/or volunteering. More than one-third (n=41) reported political activism, as well. Ten reported other activities and four indicated parenting. Only seven indicated no STEM involvement in their lives outside academics or career. Table 20 summarizes the activities reported.

Table 20. The role of science in participants' lives outside of academics or career

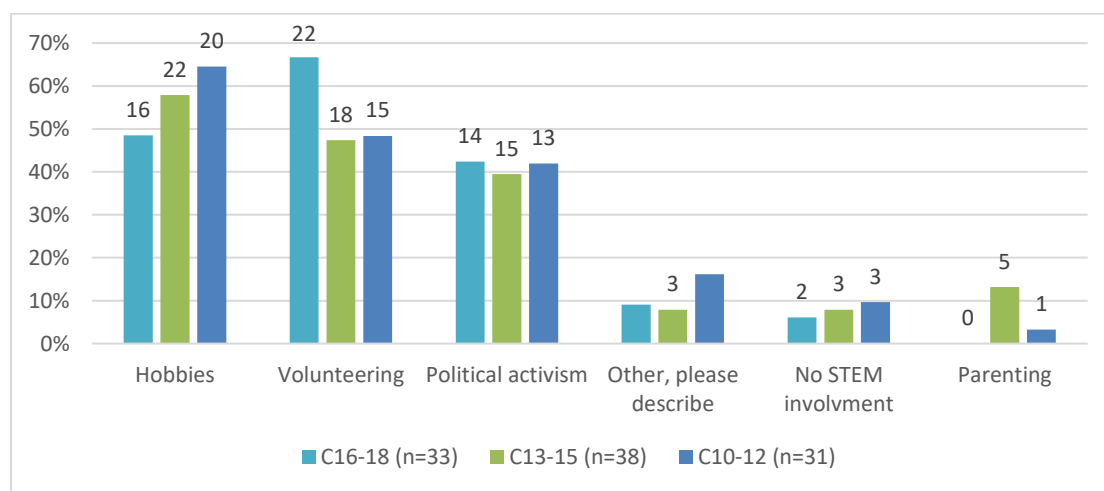
	n	% of respondents
Hobbies	53	52%
Volunteering	50	49%
Political activism	41	40%
Other	10	10%
No STEM involvement	7	7%
Parenting	4	4%
TOTAL respondents	102	

Across each of the activity types, the number of respondents who reported a moderate to high contribution of their YES! experience ranged from between 70% and 84% (Table 21). However, overall, less than half of all the respondents reported a moderate to high YES! influence on their participation in any one activity.

Table 21. The role of science in participants' lives outside of academics or career by high and low effect

	High			Low	
	n	% of row	% of 102 responders	n	%
Hobbies	43	81%	42%	10	19%
Volunteering	42	84%	41%	8	16%
Political activism	31	76%	30%	10	24%
Other	7	70%	7%	3	30%
No STEM involvement	1	14%	1%	6	86%
Parenting	3	75%	3%	1	25%

Not surprisingly, by cohort, the youngest alums were most involved with volunteering, the oldest alums, with hobbies.



Although these responses provide some insight into outcomes beyond those intended by the program, coding across the interviews and open-ended questions provided far more. These outcomes beyond those specifically targeted by the program could be categorized as involving awareness; conceptual/attitudinal shifts; interests or involvement; personal development; NMNH/Smithsonian involvement; personal development; or what can be considered “stepping stone,” i.e., indirect contribution to an outcome achieved in a different experience. Table 22 provides definitions and examples of each. Within each of these categories, there was a wide variety of outcomes and applications of knowledge and skills gained through the YES! internship. Table 23 illustrates the outcomes by program element, as described by the survey responses.

Table 22. Extended outcome category definitions and examples.

	Definition	Example
Awareness	Heightened perception	<i>... my personal life have been affected like I was more aware of the nature around me and the history behind it.</i>
Conceptual/ Attitudinal Shift	A changed idea or disposition as an articulated result of what happened in the program	<i>Familiarizing myself with different aspects of natural science made me more interested in STEM in my personal life. I try to be more conscious about how the decisions I make impact the world.</i>
Interest	Notes either a more pervasive inclination towards science and its application outside of the academic or career realm	<i>The YES! experience, to me, represents childhood curiosity in its most alive form, and is one I'd like to continue nurturing, regardless of the career path I take.</i>
Involvement	Participating in activities outside of coursework or work, e.g. hobbies	<i>I've always been interested in the field, but being immersed in a program centering around STEM accelerated my interest. I went on several deep dives in my own time.</i>
NMNH/ SI Specific	Museum visits, recounting YES! experience to others	<i>I am still in touch with the friends I made at YES! Outside of work, I enjoy visiting the Smithsonian museums and the national zoo.</i>
Personal Development	Personal life elements, such as social and relationship to surroundings	<i>The extracurriculars and hobbies I picked up all deal with some sort of science or engineering. For example, my roommates and I take care of three aquariums and one gecko in our house.</i>
Stepping Stone	Captured in other areas, however some responses illustrate creating a pathway that leads to learning for fun or volunteering	<i>When I enrolled in university I applied to work as an Explainer at NASM, a program I knew about because I worked with Explainers when I interned with YES. I worked there for 4 years through and post college. Now that I'm starting full time work in my career path, I plan to work there as an astronomy volunteer a few times a month.</i>

Participant descriptions of outcomes that occurred outside of those intended by the program often included explanation of what happened in the program that caused the outcome. These causal explanations could be categorized as: program (e.g. science communication training, field trips, TED-Ed talks, Intern Is In); people (e.g. mentors, program staff, cohort members); conceptual/attitudinal shift (e.g. changed understanding of the nature or practitioners of science); and project (e.g. the zoo, doing lab work, paleobiology). Table 23 shows the ways that these outcomes and sources related.

Table 23. Co-occurrence between beyond-intended outcome types and their causal elements.

	Program	People	Conceptual/ Attitudinal Shift	Project	Total (of excerpts exhibiting outcome)
Awareness	1	2	3	2	19
Conceptual/ Attitudinal Shift	X	1	1	1	3
Interest	1	1	7	X	18
Involvement	9	2	6	3	33
NMNH/ SI Specific	1	X	1	X	5
Personal Development	3	1	5	X	19
Stepping Stone	X	X	X	X	6
Total (of excerpts exhibiting program feature)	18	4	16	8	

Some responses, such as the one that follows, demonstrated how these outcomes could co-occur in complex ways:

My favorite part of my entire internship was the time I spent with my mentors. They were wonderful mentors, who not only trusted me, but literally took the time to know me and introduce me to everyone else in their department. I felt welcomed the entire time I was in the Department of Mineral Sciences at NMNH and at the public observatory at NASM. My mentors, and their colleagues shared their experience working in and outside of museums and how rewarding their jobs were. They were enthusiastic about going to work every day, and then, in return made me enthusiastic-- I think that was my favorite part about the whole thing. I found myself-- and honestly continue to find myself-- wanting to find a work environment as welcoming, chill, and academic as theirs. Said enthusiasm made me continue wanting to learn about geology and astronomy. I ended up joining the astronomy club at W&M and taking astronomy/physics and geology classes as electives.

This response illustrates the impact of People on this alum; however, the response indicates that they were impacted by both their mentor, as well as other scientists in the department. Further, both types of people led to multiple outcomes: greater involvement, greater awareness, and a conceptual/ attitudinal shift that was still continuing at the time of the survey.

The most frequent co-occurrence between cause and outcome involved program and involvement, indicating that program elements inspired or encouraged alums to become involved, or interested in being involved, in pursuing additional activities that would enhance, build upon, or utilize their YES! experiences or skills. Examples of this type of co-occurrence are:

The sample collecting hikes made me fall in love with nature.

I remember presenting the work that I have done over my summer during the YES! program to the public and understanding that gaps of knowledge between individuals about science and science communication. This reason made me push STEM involvement beyond my work and school.

A Closer Look at the Outcomes

Each beyond-intended outcome category encompassed a wide range of outcomes. For example, involvement in the topics listed in Table 24.

Table 24. Types and frequencies of outcomes coded as “involvement”

Interest (44 total instances)	Program
Influenced Extra-Curriculars	8
Activism	1
Advocated for Science Program Funding	1
Became involved in STEM outside of work/ school (general)	3
Educating Others	12
With Environmental Issues	1
Influenced Hobbies	4
Influenced Volunteerism	7
Sparked interest in providing accessible STEM programming	3
With Non-profits	2
With programs advocating for more female exposure	2

This list fleshes out the very minimal data available in the quantitative responses (described above). For example, most all of the multiple responses coded as “educating others” were subsumed under the “volunteering,” option provided in the item select question in the questionnaire. This more in-depth view provides richer detail about the hobbies, volunteering, and educational outreach in which the alums engaged.

Within the broader sub- outcome category of educating others, the most frequently coded sub-outcome under involved, alums indicated that their YES! experience sparked a general interest in educating others and doing outreach. Some examples in this sub-impact category are general knowledge sharing; educating on STEM related issues; participating in community outreach; and participating in classroom outreach. For example, one responder wrote that: *I was already pretty involved in STEM outside of school but it encouraged me to do more science communication in my community with younger children. It made me want them to see the fun that I see in STEM!*

The theme of educating others as an extra-curricular also arose throughout the interviews. M1 and F9 both mentioned becoming involved in local communities or sparking a passion for outreach. F9 wrote that:

Through the field trips that involved conservation of the planet and through my close involvement with animals at the zoo, I have taken on roles in clubs where I educate others about the importance of conservation. In addition, by the example of the YES program leaders, I have realized the importance of giving back to the community and through college I am planning on being a part of AIDs outreach in the Philadelphia community and aiding the global community through aid trips to Kenya and Honduras through programs funded by my school.

The YES program had a built in outreach project, which was my first science outreach project that forced me to get experience in talking to a younger audience about nature. Since then, I've gotten the courage to use the insect collection I've made to go to other school groups and give similar talks on the theme of outreach.

Within the broader sub-impact category of volunteering, the qualitative responses helped provide a deeper understanding of the variety of volunteer opportunities aside from community outreach/educating others.

I am still very passionate about science. I volunteer with Bernie Sanders and his plan to combat climate change, a topic I learned a lot about at the NMNH. A lot of my artwork is about natural science. I like to learn about the subjects of my paintings which are usually plants, animals and people.

When I enrolled in university I applied to work as an Explainer at NASM, a program I knew about because I worked with Explainers when I interned with YES. I worked there for 4 years through and post college. Now that I'm starting full time work in my career path, I plan to work there as an astronomy volunteer a few times a month.

It was my experience with working at the National Zoo that made me realize that I wanted to volunteer by helping out with animals even in college.

My YES experience has made me enjoy volunteering to help clean out the lakes, rivers and trails so that others can enjoy it as much as I do. I have a much deeper appreciation for all living being because of it.

When discussing hobbies and extra-curriculars, some wrote that their experience sparked a greater interest in finding outdoor hobbies:

YES! allowed me to explore hobbies (hiking, camping) outside of sports such as spending more time outdoors to learn about the environment.

While others were propelled to explore more learning opportunities for fun during their spare time.

The variety in the forms of involvement illustrate the range in the application of skills and knowledge outside of the career/ academic fields. While alums who become more involved in educating others or activism may utilize their science communication skills more frequently, alums who report taking on additional extra-curricular learning opportunities show an application of knowing how to seek out information and gaining knowledge for fun.

The nuance within the involvement outcome, and application of skills and knowledge beyond an academic or career context, isn't unique to this category. YES! also promoted a variety of types of awareness, interest and personal development outcomes.

The two outcome categories that had the most related responses after involvement were awareness and personal development. Alums indicating a heightened awareness as a result talked about mindfulness pertaining to modern applications of science, science related issues, and impacts of programming such as YES!

Science is a crucially important discipline that is essential to learning about the most pressing issue of our current age, climate change. Working in a science related position helped me appreciate this reality.

It made me realize that a lot of the subjects in stems are very much related and that even though self-awareness of political issues could help our planet in a good way.

I got to participate in research and that provided a lesson that science is a slow, incremental process. That upended my prior perception.

It influenced me to discover and to look for other opportunities that can not only further my interest in STEM, but also gave me an idea of what I should take from an experience such as this one.

When discussing personal development outcomes, alums wrote about impacts on their choices in media, choices in pets, friendships from YES!, heightened social confidence, encouraging a love for travel, and encouraging a love for nature.

I learned that there are various types of science that I can experience in nature and with people, and that has influenced the types of media I read and watch. People are also interest when I recount my experiences with the YES! program.

The program made me more comfortable with small talk and public speaking, so I gained confidence in my ability to move in circles that I wouldn't necessarily "fit" in.

Sparked or reinforced interests were mentioned within the responses, however the interests ranged in focus on STEM and its everyday application, science and art connections, community activism, and educational accessibility. Responses ranged from discussing general curiosity:

The YES! experience, to me, represents childhood curiosity in its most alive form, and is one I'd like to continue nurturing, regardless of the career path I take.

To considering mindfulness and who is made aware of different concepts:

The STEM involvement through healthy living and mindfulness of our outer universe made me think about how these ideas are not reflecting or taught to diverse students. I want STEM ideas to be accessible in minority households.

Beyond-intended Outcomes. In the interviews, three beyond-intended outcomes that appeared most frequently were the development of transferrable skills, an awareness of or interest in combatting barriers to STEM accessibility, and finally alum development of a stepping stone experience.

Regardless of whether or not alums pursued an academic or career path in STEM, it seems that they were able to gain skills through their YES! experience and apply them in their professional and personal life. Both F4 and F8, though not currently pursuing careers in the STEM field, have applied skills and/or knowledge that they've gained. F8, at the time of her interview, talked about applying her knowledge from YES! and interest in the natural sciences to the art she creates. Further, she pursues her interest in climate change through volunteer opportunities with political campaigns. F4, during her interview and survey responses talked about her gained interest in pursuing environmental issues from a political lens. Thus she was able to take her science knowledge and communication skills and apply them to a different sector of work.

The qualitative responses also talked about applying skills gained from YES! to other sectors of work and to personal matters.

The YES program was my first opportunity to work in a field I was interested in. Even though I don't currently plan on working in the field of science I have learned professional skills and how to communicate that will help me in my field of Law. Also my summer working with the Genome Project has sparked my interest in learning about the legal side of science and how science and law interact.

It wasn't the content of my research during my YES! experience that affected my career choice. It was the people and the tasks. The tasks we were given forced us to keep an open mind and explore. I decided I would want to explore forever and explore ways to better lives (not exactly through natural science) but using my interests in psychology and research to eliminate workplace abuse and toxicity.

I work as a cashier at Yes Organic Market & customers service is key, working at YES! helped me with interacting with visitors or in my current case, customers.

I learned the skill of being self-motivated and understanding that seeing things in a positive view is important. I learned that not everybody has the opportunity to participate or involve themselves in something they appreciate. I have used this as a way to help others and myself to believe in themselves and that they can be a part of something bigger and break that mentality of being stuck in a place, and how everyone can persevere and create a change.

Familiarizing myself with different aspects of natural science made me more interested in STEM in my personal life. I try to be more conscious about how the decisions I make impact the world.

When it came to YES! combatting its interns' barriers to access to STEM, F5 mentioned seeing and learning from scientists and staff and NMNH, who looked like her and had similar first-generation college backgrounds, helped her realize that she could pursue similar careers. Furthermore, F9 said even though she grew up in DC, she felt a lot of doors had been closed to her and the museums were not necessarily accessible to her. As a result, YES! afforded her access and opportunities she otherwise would not have had and that have greatly impacted her for the better.

Having experienced barriers to STEM access themselves, many YES! participants went on to leverage their YES! experience in order to expose others to science. F9, for example, was motivated by YES! to go into science education in order to do for others what YES! did for her. F5 and F7 combatted barriers for women in STEM, in particular, by starting a nonprofit called Your Girl for Good. F1 went on to get involved with women in tech support networks. Other ways F1 impacted others in a long-term way after YES! were through the national community service program she started and the company she founded, which compiled internship opportunities.

While M1 did not mention experiencing barriers to access himself, he did note that he knew people in his cohort that had. After YES!, one way he positively impacted others in a long term way was through exposing kids to science through his Bezos Family Foundation sponsored science outreach festival.

This interest in outreach to deconstruct barriers was also addressed in the qualitative responses. Alums talked about general interest in providing accessibility, interest in doing outreach, and pursuing educational degrees to mitigate these concerns.

It taught me a lot about my privilege to receive a good education and made me want to work on making it available to everyone.

I believe outreach is always important with youth and especially with youth who may not have had exposure to professions that aren't necessarily visible to the public. So although I don't study the field I had exposure to through the YES program, I still bring with me the philosophy to give back to the youth by volunteering for outreach programs at my university.

During my time in YES!, my internship was with in the botany department. Although I was very hesitant at the time about how my experience would be, it turned out that not only enjoyed the experience and learned a great deal, but I enjoyed the museum scientist and staff. I also made many new friends. But the YES! Program helped me realize that I want to work with youth and with a similar program like YES!. So I decided to go into Education, Advocacy, and Social Work. My college had a major that combined all of these in one major; Community Education.

Another outcome of this internship was that the experience served as a stepping stone towards more internal and external learning opportunities. Within NMNH, interns have the opportunity to continue their experience as high schoolers through YES! 2.0 or 3.0 or as an undergraduate through Natural History Research Experiences (NHRE). Building and improving upon an internal structure for students to progress along or enter into at any point is a current point of interest at the museum and will be included in the upcoming museum strategic plan.

The YES! experience was oftentimes the first internship for students and served as a launching pad towards more opportunity. This crafting of a path, seeking out additional internships and opportunities outside of the museum, is an unexpected outcome. F1 is an example of this experience. In her interview, she stated that: *I've had internships since then [freshman year of high school]. It's honestly because when I applied to YES!, I never thought internships were a thing in high school, and after that internship I was like, 'I have to match this. I have to go above and beyond.'* So I did. M1 also had a similar trajectory, taking advantage of a variety of STEM opportunities and building upon his experiences at NMNH.

Multiple alums shared that they had chosen after the YES! program, to pursue further opportunities:

YES! opened my eyes to the many programs that exist for high school students with an interest in science. Furthermore, my involvement in YES! gave me the confidence to seek and apply to these other opportunities.

While others gave more specific examples of opportunities they chose to pursue or the ways their new opportunities influenced them:

It motivated me to pursue other research opportunities. I did invertebrate zoology research at the NMMH Smithsonian my senior year and was selected as one of the three students to represent the USA at the 2014 millennial youth camp.

It led me to pursue more science education experiences, which led to a passion for botany and agriculture.

Several of the alums who have created their own pathway, utilizing the resources at and outside of NMNH have started to pave a way, and articulated an interest for people coming after them. F1 created a database that included opportunities for high school students, F5 and F7 created a non-profit geared at providing access to STEM for minority women, F10 seeks to make science education more accessible, while others such as M1 have sought out local opportunities to reach out to local school audiences.

Results Q3. Program strategies that contributed to learning.

What we learned

Of all the program strategies, study participants rated mentoring as contributing most to their learning.

YES! alums described themselves as learning across five categories: learning specific skills or content; learning about their personal academic or career direction; learning from exposure to broad ranges of opportunity, learning through forming social relationships; and learning through finding value in sharing learning with others and helping them learn.

Key program components—mentors, peer interns, and staff—contribute to the broadest range of these learning categories.

Tour field trips also provided equally broad contribution, perhaps suggesting that an equally key aspect of YES! is its location at the Smithsonian and its relationship to the broad range of Smithsonian scientists, research, and museologists, and educators.

Program strategies such as Community Day, Intern is In, TED Talks, and Science Communication Training were particularly important to building knowledge and skills. Some were particularly noted for their value in providing an opportunity to share that learning with others.

Additional strategies emerged as important to the program. These included opportunities to talk with scientists; the value of the research project and working in a lab; the importance of peer interaction, and diversity within the cohort and staff.

How we know

YES! interns rated internships with their science mentors (17%) as comparatively accounting for the greatest contribution to their learning. They rated the next five experiences fairly evenly, ranging from 11% to 13%, followed by two (TED talks and Museum Staff) that were also close in

their contribution scores at 9% and 8% respectively. Interns rated “Intern-is-in sessions” and “Community day/teen takeover” as having made the smallest contribution to learning, each at 4 % and 3.74 respectively. Table 25 breaks down the contribution for all 10 activities.

Table 25. YES! experiences’ contribution to intern learning

Strategy	%
Internship with your science mentor	17%
College Prep Workshops	13%
Science communication training	12%
Behind-the-scene tours and field trips	12%
Informal talking sessions with scientists and college students	11%
Interactions with fellow YES! interns	11%
Preparing and delivering your YES! TED-style presentations	9%
Interactions with museum education staff	8%
Intern is In sessions	4%
Community Day/Teen Takeover	4%

The Selected Program Strategies Contributed Differently to Learning

Coded Qualitative responses provided insight into how each of these programs contributed to learning. Based on top-level codes defined in method section Q3 above, Table 26 lists for each program, the number of subcodes referencing a type of contribution to learning (the more detailed version with listing of subcodes can be found in Appendix C). The distribution of comments across the learning types reveals important conclusions about each strategy.

Table 26. Counts of questionnaire sub-codes indicating per program types of contribution to learning

	Contribution Types					Count of Contribution Types
	Direction	Exposure	Learning Content or skill	Social	Value	
Community Day			13		1	2
Intern Is In			10		1	2
Staff	2	2	5	1		4
Talking Sessions	11	1	9			3
TED			24		1	2
College Prep	21	2	8			4
Science Communication Training	4		36		1	3
Tour Field Trips	10	9	16	1		4
Fellow Interns	7	3	15	14		4
Mentor	14	1	33	4		4

Reading across each row of Table 26, provides some understanding of how each program strategy functions within the YES! program as a whole. Not surprisingly, key program components—mentors, peer interns, and staff—affect the broadest types of learning contribution. Tour field trips also provided equally broad contribution, perhaps suggesting that an equally key aspect of YES! is its location at the Smithsonian and its relationship to the broad range of Smithsonian scientists, research, museologists, and educators. Also of interest is that the strategies that appeared to contribute solely to acquiring learning skill or content also were the ones identified as having value to others beyond the program – i.e., they involved not only acquiring information and skill, but also sharing it beyond the program.

The open-ended written explanations for program activity ratings provided the structure for Table 26; stories from the interview illustrated their depth. The following examples from those stories help to explain the intersections between the program strategy and the learning categories. They are presented below in order of the program strategies listed in the table. To see the rich and vast topic areas that constituted each learning category, see Appendix C.

Staff. Curiously, staff interaction influence arose more frequently in the stories and responses than would have been predicted by the 4% apportionment in the questionnaire responses. F6 spoke about how the staff took the time to speak with her about her interests and career path which helped her choose (direction).

TED talks. Through listening to a TED talk by one of her fellow YES! interns F4 recognized that “no matter your identity, there is a place for you in STEM” (exposure).

College Prep. College visits helped F7 understand what college life might be like; and the college talks helped “level the playing field” for F5, who is a first-generation college student (direction). A financial talking session helped improve F9’s financial literacy by teaching her concepts such as the importance of credit (skill/content).

Science Communication Training. Through science communication training, M3 developed self-confidence and a sense of self efficacy (skill/content)

Tour Field trips. On a Tour Field Trip, F10 learned about climate change (content/skill); another exposed M3 to informal science education outside of NMNH—sparking his pursuit of a career in science education (direction).

Fellow interns M2 talked about his fellow peers (fellow interns) pushing him to strive for greatness and apply himself. For example, he said he looked up to the YES! interns above him in YES! 2.0 and that they motivated him to progress through the YES! Program - going on to do YES! 2.0 and YES! 3.0. Along with another YES! intern, F5 and F7, who met through YES!, went on to found a nonprofit aimed to involve underserved women in STEM (value).

Mentors. Being involved with her mentor and NMNH research helped F4 see that not all researchers were “straight-laced PhDs” (exposure) and for F10, it sparked her interest in pursuing research by showing her research was more than just what she had done in class (exposure).

Mentors contributed to learning through encouragement both during the internship and for future direction. Usually descriptions of mentor caring, interest, and authenticity – or realness— accompanied these explanations. For example, F10 spoke about how her supportive mentor helped her understand that although her role was small, she was making an important contribution and that projects boil down to teamwork.

Similarly, F3’s mentor was “thoughtful enough” to help make the lab setting feel less intimidating to the interns by giving them a chance to see the lab before the program started. He also looked out for his mentees by passing along opportunities he came across and talking to them about college. Ultimately, F3 applied to YES! 2.0 because of her mentor. In addition to his serious attention to his work, he could have fun, develop genuine relationships with his mentees beyond the work, and happened to come from the same country as her parents.

F5 came into YES! interested in science, but, because her parents did not go to college, she was unsure how to formally pursue it. As a result, YES! mentorship impacted her greatly in that her YES! mentors were able to answer her questions about next steps.

Additional Unlisted Strategies

In their written responses, YES! alums spoke or wrote about additional strategies not appearing in the rating list.

Although not on the rating list, **Reach 100**, a more recently introduced strategy whereby interns must share their research with at least 100 people, gave F9 the opportunity to use her science communication skills to impact people outside of YES! (Value).

Opportunities to talk with scientists afforded by Tour Field Trips and Museum Staff Interaction motivated both F10 and F8 to current political activism (value). For F9, these opportunities helped remove barriers to STEM involvement and for F2, inspired her current career pursuits (direction). Through these discussion and interactions, M2 found further opportunities to work his way up the NMNH career ladder (direction), and F4 learned firsthand the benefits of building a professional support network (skill/content).

Working in a lab, though not necessarily a dominant theme in the responses, elicited mixed experiences with YES! Interns. Some indicated that their experience working in a lab and learning the affiliated skills was a positive experience, in part due to the environment in which they worked.

“I worked with Dr Ross Robinson aquatic species collection. N--- A--- was my mentor; I worked along side her. There were mornings that I was so exhausted but she made extracting DNA fun and interesting while practicing safety in the lab. I went into this program last minute not knowing where I would fit properly, but I figured I would give

it a chance. I'm so glad I did. I had never had consider making science a career until I stepped into the lab and in that moment I knew that science was for me."

Others indicated that this experience helped them realize that they wanted to approach a science subject from a different angle:

"It made me realize I liked biology but not so much the lab aspect. I picked math with the intention of doing applied math for biology later on."

The Research Project. Similarly, participating in a research experience fostered a better understanding of the process of doing science:

"My internship with YES! made me realize that research was for me! Some people don't like to research anything but my hands on experience at YES! made me find a love for it. Also, I fell in love with the tools we used for statistical analysis and decided I wanted to do similar things during my career. Of course I didn't go the natural science route but I did decide that I wanted to develop new ways to analyze workplace abuse and performance management. I figured this out through amazing conversations with Elio Cruz, former YES! Program Coordinator and my insightful and interesting mentor Graham Slater."

Diversity of staff and cohort. Cohort and staff/mentor diversity also emerged as an important program strategy. Both F9 and F4 mentioned that this diversity helped them understand anyone can be a scientist and partake in STEM. F6 said that unlike other programs that she had been a part of, YES! exposed her to people unlike herself, particularly those not from DC and that this exposure was very beneficial to her.

F5 said that the opportunity to not only see and learn from professionals who looked like her, but also to speak with them about their experiences and the work they were doing, helped her see herself as someone who could pursue science. She also said that the diversity of the staff, both in their racial and first-generation college identities, helped her connect with and relate to them as well as understand what it is like to be a minority in science. Similarly, F6 spoke to how having a mentor who was Latina like her and who was candid about her experience as a Latina in STEM, helped her understand not only her place in the field of science, but also that she too could pursue STEM. Moreover, like F5, F6 said the fact that the staff was racially diverse, had first generation college backgrounds, and were from DC, helped her connect with and relate to them. The diversity of the YES! mentors and staff gave F7 the opportunity to meet women in STEM and realize that there were many STEM fields still lacking women. Like F5 and F6, the diversity of the staff and mentors benefitted F9 in that it allowed her to see anyone could partake in STEM.

Importance of peer interaction. An additional aspect of strategies and their effect is what makes them work. In this regard, relationships were central. M1, M2, M3, and F6 all spoke of building friendships with their fellow YES! interns. F6 added that her cohort grew to feel like a family and that they even did things together on the weekends. F2 spoke of the staff simply knowing her name on the first day helped her feel she belonged from the start. F6 was able to relate to and feel like she

belonged within her YES! professional network because they had similar backgrounds to her and her fellow interns. Not only were they similar racially, but they too had grown up in DC.

Results Q4. Visions for a vibrant Alumni Ambassador Program

What we learned



Participant responses showed good reason to believe an alumni network have plenty of interested members and would fill an important need. Only two respondents said they would have no interest in staying in touch, while more than a third reported no longer being in contact with any YES! colleagues. Most wanted to maintain contacts for the purpose of staying in touch with friends, followed by maintaining a network for career advancement and generally to satisfy curiosity about what colleagues are doing (each were reasons for about a third of the respondents).

Only half of the responding alums would choose to stay in touch with YES! staff. Their reasons were to maintain a network for career advancement (34%) and to maintain friendships (25%).



Most of the responding alums also said they were interested in providing support to current YES! interns' applications and planning for college. Just over half were interested in sharing lessons learned from their own YES! experience and in attending YES! presentation events.

How we know

Participants reported how many people from their respective cohorts they remain in contact as well as who. Nearly 40% have no contact with people from their cohorts. However, as shown in Table 27, almost half of even the oldest cohort maintains contact with at least one YES! colleague.

Table 27. The number of people from their cohorts with whom participants remain in contact

	Total		2016 - 2018		2013- 2015		2010 - 2012	
	n	%	n	%	n	%	n	%
None	38	38%	6	11%	16	42%	16	53%
One	23	23%	8	15%	6	16%	9	30%
Two	16	16%	5	9%	8	21%	3	10%
Three or four	16	16%	9	17%	6	16%	1	3%
Five or more	7	7%	4	8%	2	5%	1	3%
TOTAL	100		32		38	100%	30	100%

Participants also selected reasons they would remain in contact with their YES! intern colleagues. As shown in Table 28, three quarters of participants (73%) indicated that maintaining friendships

was the primary reason followed by maintaining a network for career advancement (40%) and out of curiosity about what they're doing (36%). **Only two participants indicated they would not be interested in staying in contact with their intern colleagues.**

Table 28. Reasons to remain in contact with YES! intern colleagues

	n	%
To maintain friendships	73	73%
To maintain a network for career advancement	40	40%
Out of curiosity about what they're doing	36	36%
To maintain a network for academic help	24	24%
Other	10	10%
To help inform the program	8	8%
I have no interest in staying in contact	2	2%

Further, participants reported the reasons they would maintain contact with YES! staff. Not surprisingly, responses indicated fewer social reasons and more academic and career reasons. As shown in Table 29, fifty participants (50% of overall respondents) indicated that they would remain in contact for career advancement as well as 28 for academic help, which makes sense considering about half were responding as students. Approximately one third (n=36) also indicated that they would stay in touch to maintain friendships.

Table 29. Reasons to remain in contact with YES! staff

	n	%
To maintain a network for career advancement	50	34%
To maintain friendships	36	25%
To maintain a network for academic help	28	19%
To help inform the program	16	11%
Other	15	10%
Out of curiosity about what they're doing	-	-
I have no interest in staying in contact	-	-
TOTAL	145	

Participants also reported on the ways they would be willing to support current YES! interns. Responses, listed in Table 30, revealed a decided emphasis on academic mentorship with three-fourths of them indicating they would be willing to provide support for college application and planning. More than half also indicated they would be willing to share lessons learned from their YES! experiences and attend YES! presentation events (55% and 54%, respectively). Overall, with them reporting 289 ways in which they would be willing to support current YES! interns, the YES! alumni showed a great deal of willingness to support their successors.

Table 30. Ways participants would be willing to support current YES! interns

	n	%
Advice and support applying to or planning for college	73	73%
Share lessons learned from your YES! experience	55	55%
Attend YES! presentation events	54	54%
Serve on career panels	42	42%
Conduct college tours	35	35%
Share information about other Smithsonian opportunities	27	27%
Other	3	3%
TOTAL	289	

When asked how interested they are in participating in a support network for YES! alumni, as shown in Table 31, two thirds (67%) of participants indicated a great deal or a lot. An additional 16% indicated a moderate amount. Only 17% indicated a little or none at all. YES! alumni, then, have a great deal of interest in participating in a support network. This aligns with their reporting a great deal of interest in specific activities.

Table 31. Interest in participating in a support network for YES! alumni

	n	%
A great deal	33	34%
A lot	32	33%
A moderate amount	16	16%
A little	14	14%
None at all	3	3%
TOTAL	98	

We also asked participants whether they would be willing to share information about themselves (e.g., phone number, email address, current occupation, etc.) in an alumni directory. At 87%, the YES! alumni overwhelmingly indicated they would be willing to share their personal information (Table 32).

Table 32. Willingness to share information in an alumni directory

	n	%
Yes	81	87%
None at all	12	13%
TOTAL	93	

When asked what additional ideas they had for keeping YES! alums involved with the YES! program, responding alums wrote suggestions primarily centered around fostering community and increasing communication.

As ways of fostering community, the most suggested methods were more meet ups and increased alumni involvement in YES!. Respondents who suggested meet ups mentioned reunions, events at NMNH, social meet ups such as happy hours, networking meet ups, and cohort meet ups over the summer. Those who suggested increasing alumni involvement in YES! proposed hosting alumni panels, such as alumni college panels, having a meet alumni day, holding an alumni career day, and inviting alumni to the final presentations.

Additional ideas for fostering community were alumni meetings, initiative by age group, internal mentorship, such as alumni mentor-mentee pairings, networking events, and internal networking.

As strategies for increasing communication, the most suggested methods were social media groups, such as a Groupme or a LinkedIn group, a YES! directory, perhaps organized by college attended, and an email list. Other suggestions to increase communication included a newsletter and sharing the progress of YES! Alums.

Additional ideas for maintaining a YES! alum network involved feedback tools, such as shaping YES! through alumni input and advice, tracking the progress of YES! alums, an anonymous advice column, monthly meetings, outreach efforts, such as reaching out to others about YES! and reaching out to YES! alums, and events with food.

Alum Suggestions for Improvement

In addition to being asked to describe how each of their highest scored components impacted them and their reasons for scoring them highly, respondents were asked what changes they could suggest that would have made their YES! experience have had a greater impact. In response, they mentioned the themes of program content/structure adjustments (meaning changes to the context and/or structure of the program), increased community (meaning increases to efforts that would have fostered and/or sustained the YES! community) and none (meaning no suggestions were indicated) with the most frequency.

Within content adjustments, the most suggested changes were to the project. These changes included additional research opportunities, more project days, more departments for projects, the opportunity to see a project through completion, involvement in multiple projects, more in-depth research, and more meaningful projects.

The other suggestions proposed within content adjustments were increased career prep, increased college prep, additional field trips, changes to the soft skills development arc, increased opportunities for questions, more 1:1 activities with scientists, the opportunity to shadow non-science staff, study sessions, and volunteer opportunities outside of their project field.

Suggestions related to increased career prep included efforts to increase career understanding (both increasing understanding around next career steps and around how one becomes NMNH staff), offering workshops on making a LinkedIn, and holding more prep courses for careers in science. Suggestions related to increased college prep included arranging a wider selection of college visits, offering ACT/SAT prep, and increasing college mentorship. Suggestions related to

changes to the soft skills development arc included having alternatives to public speaking, less soft skill development, and, conversely, more public speaking preparation.

Within increasing community, the most suggested changes were around increasing YES! communication. These suggestions included staying in touch with alumni, sending more updates on the current YES! cohort, and disseminating a newsletter. Other suggestions related to increasing community were having more alumni events, creating social media groups such as a Groupme, holding more bonding events, and doing more ice breakers.

Other changes respondents suggested were increasing the agency participants had through efforts such as increasing their say on projects and mentor pairings, increasing the length of the internship, decreasing the length of the days, interaction with other internships and youth groups, providing an SI staff directory, taking into account special considerations such as anxiety or dyslexia, and having more YES! director check ins.

Lastly, to gain a complete understanding of the impact of YES!, participants were asked what conditions in their lives affected the impact of their YES! experience. In response, they mentioned the themes of standing interests and/or experiences, their personal lives, and those involved in YES! with the most frequency.

Summary: Responder-Reported Effect Extrapolated to All Interns

The 40% non-response rate presented a serious limitation to this study. Utilizing an extrapolation formula provides a way of addressing it. The formula used here derives from the conservative assumption that **all non-responders** would have reported an average YES! contribution to their science status (academic major, career choice, science interest, science communication and leadership skills) as averaging **one standard deviation below** the mean of responders. Based on this formula for non-responders, Table 33 below shows, for both responders and non-responders, the mean sample response to each of these contribution measures along with a calculated average across the five measures.

Table 33. Responder mean perceived contribution scores with non-responder scores calculated as one standard deviation below the responder mean.

	N	Min	Max	Mean	sd	Non-Responder N	Non-Responder Mean*	Whole Group Mean
College Major	100	1.0	5.0	3.6	1.2	77	2.4	3.1
Career	100	1.0	5.0	3.4	1.2	77	2.2	2.9
Science Interest	74	1.2	5.0	3.6	0.8	103	2.8	3.1
Science Communication Contribution	98	1.0	5.0	3.3	0.9	79	2.3	2.9
Average Mean Contribution	102	1.0	5.0	3.5	0.9	75	2.6	3.1

* extrapolated as the sample mean less one standard deviation

Low, moderate, and high categories grouped responses into those that were less than 2.5 and low; above 3.75 as high; and the remaining as moderate. Based on these groupings, as shown in Table 34, 9% of responders reported moderate to high average contributions. The non-responder mean (2.6; N = 75), distributed equally across a range determined by one standard deviation from that mean (2.1 to 3.7), lead to 19 non-responding alums (25%) below 2.5 in the “low” group and 56 between 2.5 and 3.75 (75%) in the “moderate” group. Note that the conservative decision to distribute the results equally across the mean created more members for the low group than would a standard distribution.

Table 34. Actual responder and extrapolated non-responder mean contribution scores divided into low, moderate, and high categories

	n	Percent	Valid Percent	non responders*		Extrapolation to all alums*	
Low (<= 2.50)	11	6.2	11%	19	25%	30	17%
Moderate (2.51 - 3.75)	43	24.3	42%	56	75%	99	56%
High(3.76+)	48	27.1	47%	0		48	27%
Total sample	102	57.6	100.0				
Total population	177			75			

Extrapolation formula: non responder mean (2.6; N = 75) distributed equally across a range determined by one standard deviation from the mean (2.1 to 3.7) leads to 19 alums below 2.5 (categorized as low) and 56 between 2.5 and 3.75 (the moderate group)

Added together, the extrapolation suggests that 83% of all alums (responding and non-responding) perceived a moderate or high YES! contribution to their current science status. Just over a quarter of the population (27%) perceived a high contribution.

Conclusion

This YES! at 10 retrospective evaluation sought to answer four evaluation questions. To answer them, nine interns, a research fellow, and an NMNH educator worked with the COSI Center for Research and Evaluation to answer them. Together, the nine interns, one from each of the YES! cohorts located and recruited into the study a total of 102 YES! alums, 60% of the total YES! alum population. After completing a questionnaire that included, in addition to quantitative measures that have been used to evaluate the program over the past three years, 13 open-ended questions, thirteen alums were selected for best-case scenario interviews. Success case selection provided a means for seeing how well the program could succeed in order to set goals for making these success cases the norm. After collecting the data via online surveys, the interns developed coding schemes for each of the questions. The NMNH educator and NMNH research fellow then refined the codes, conducted analyses and contributed substantially to writing this report.

The YES! internship program intention was to open science academic and professional doors to young people from population groups typically under-represented in the science professions. Over

ten years, YES! contributed at least moderately to the current science status of an estimated 80% of its 177 total participants. This status included choice of academic major; career choice; science identity; science interest; and leadership skills. For a portion of this group, an estimated 27% of all participants, YES! contributed highly, having provided an impactful and lasting experience. This report has captured the range and types of these impacts with stories from 13 of the 48 alums in this group.

For just over half of YES! participants, the internship contributed moderately, often functioning as a stepping stone to other equally or even more influential STEM opportunities. Where possible, this report has documented those “stepping stone” experiences.

It was beyond the scope of this project, but further analysis could be conducted to separately understand the experiences of the moderate and low YES! contribution groups, even asking very specific questions. For example, to better understand the “pipeline” experience of the YES! lower impact group, a researcher could analyze both quantitative and qualitative responses from a 1st cohort (2010-2012) subgroup made up of alums with science majors, but not science careers. Many differing subgroup analyses are available for answering a wide array of about that group’s experience.

However, within the scope of the project was to answer four evaluation questions, with the first having five subjects. Following are short-version answers to each question including recommendations where appropriate.

Q1. To what extent did the YES! high school internship contribute to each of five intended program outcomes? (As listed in the introduction above:).

(1) instill specific science-related content or skill;

YES! has exceeded its goal of instilling specific science related content and skill. Alums wrote and spoke of specific science content; science skills that included research, science communication, and lab skills. Equally important, alums acquired academic, workplace and personal development skills. These included communication, self-knowledge, and academic knowledge and skills that included college selection, entrance, and academic learning.

(2) promote and affect interest in and motivation for studying science and science careers;

On the average, across all interns, including non-responders, science identity improved. Put differently, even if every non responder had lost their interest in science, because of the high rate of increased science identification among responders, more than 50% of the whole group would still have reported a gain.

Of the oldest cohort (7 to 9 years post high school graduation), 91% had selected a science major; 68% had graduated from college and 45% were pursuing a STEM career at the time of the survey. Across the whole YES! alum population, even if every non-responder had left college before graduating, half would have pursued a STEM major, a third would have graduated, and a quarter would be pursuing a stem career. These numbers compare quite favorably to those of the general

population “leaky pipeline” study that showed that of all college ready seniors, one fifth chose STEM majors and just over a tenth graduated from college (National Science Board, 2008).

For the YES! alums, who participated in this study (60% of the alum population), YES! experiences led to conceptual and attitudinal shifts that helped interns find clarity about academic and career direction or gain more general career awareness and interest.

(3) enhance skill and confidence with communicating about science;

In general, YES! enhanced alums’ skill and confidence with communicating about science—for some, not all. On the other hand, many alums spoke about science communication differently: their building their science communication skills worked to enhance their self-confidence rather than the other way around.

(4) enhance 21st century skills (including communication; critical thinking; creativity; leadership; identity, and social and emotional literacy)

Alums wrote and spoke of the breadth and depth of skills gained that will better serve them functioning in today’s world. The 21st century skills most frequently represented by alums were communication & collaboration, initiative & self- direction, and critical thinking. However, based on the quantitative measure of the YES! program’s contribution to leadership skills, older cohorts attributed more of their skill to “YES!” than did younger.



Recommendation: This finding suggests that program administrators will benefit from further exploring the reason for this difference, and if necessary, making program changes, perhaps even return to some earlier strategies, that promote leadership.

(5) creating both professional and peer support networks.

Alums described networking as a well-appreciated skill acquired through YES! and applied it to reach goals academically, in careers, and beyond school and work. On the other hand, examples of within-group networking were far less frequent.



Recommendation: Taken together with how these alums expressed interest in within-group YES! networking, in future years, YES! staff and administrators might include more program strategies to lay foundations for ongoing peer and professional NMNH-Smithsonian networks during the internship.

Q2. To what additional (e.g., lifestyle, parenting, etc.) longer-term outcomes did the YES! internships contribute?

Outside of school or work, more than two thirds of the responding YES! alums engaged in at least one type of STEM-related activity. Most frequently the activities involved hobbies or volunteering, and slightly less so, for political activism.

YES! alums experienced beyond-intended outcomes that could be categorized as involving awareness; conceptual/attitudinal shifts; interests or involvement; personal development; NMNH/Smithsonian involvement; personal development; or what can be considered “stepping stone,” i.e., indirect contribution to an outcome achieved in a different experience. Respondents

often ascribed these outcomes to the program, the people in the program, to conceptual shifts in thinking or understanding, or to the project in general.

Among the alums who benefitted most (as represented by the interviews) frequently occurring beyond-intended outcomes included transferrable skills (e.g., science to art), an awareness of or interest in combatting barriers to STEM accessibility, and finally alum development of a stepping stone experience towards other internship opportunities spanning different fields.

Q3. What program strategies affected the level and type of program impact?

Of all the program strategies, study participants rated mentoring as contributing most to their learning. Key program components—mentors, peer interns, and staff—contribute to the broadest range of these learning categories. Tour field trips also provided equally broad contribution, perhaps suggesting that an equally key aspect of YES! is its location at the Smithsonian and its relationship to the broad range of Smithsonian scientists, research, museologists, and educators.

Q4. Envisioning a vibrant Alumni Ambassadors program.

Participant responses showed good reason to believe an alumni network have plenty of interested members and would fill an important need. Only two respondents said they would have no interest in staying in touch while more than a third reported no longer being in contact with any YES! colleagues. Most wanted to maintain contacts for the purpose of staying in touch with friends, followed by maintaining a network for career advancement and generally to satisfy curiosity about what colleagues are doing. Suggestions for maintaining an alum network involved strategies for both fostering community and communication.

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Appendices

Lifelong Learning Group

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Smithsonian- NMNH

February 2020

YES! at 10

Appendix A. The Questionnaire

Intro

Welcome to the NMNH 2019 YES! at Ten Alumni Study!

Thanks so much for participating. The purpose of this study is to help us learn more about YES! Alumni, how their YES! experience has affected them, and how we can extend the YES! alumni experience to meet current needs and engage alumni with current interns.

For a detailed description of the questionnaire and your participation, click on this link. Please read it over to help you decide if you would like to participate in our study. This questionnaire should take you about 45 minutes to complete. If you need to take a break, that's ok. Your answers will be saved.

We do not anticipate any risks to you by participating in this study. The only anticipated benefits are that your feedback may help strengthen the NMNH YES! Alumni experience. Your responses will be anonymous – not linked to you. No personally identifying information (like your name, your address, your school) will be collected.

Completing this survey is completely up to you, and you can choose not to answer these questions or to stop at any time without any consequences. If you have questions about this study or would like a copy of this page, please contact the director of the evaluation: Deborah Wasserman, Ph.D.; Research Associate; Lifelong Learning Group: dwasserman@cosi.org or phone 614-629-3123.

If you have any questions about your rights or concerns that you can't discuss with the investigator, you may call the institutional review board: E&I Review, phone: 816-421-0008.

By clicking "Next Page" below, I indicate that I have read the above information, had the chance to ask questions and receive answers, and I consent to take part in the study.

P.S., note that if you need to leave your survey and return, that's ok. When you use the same link, the survey will reopen just where you left off.

Academic and Career Paths

These first questions are about your academic and career paths.

If applicable, in what field are you working and what is your job title?

Are you attending or did you attend college?

- Attending
- Attended
- Graduated
- Planning to attend
- On leave, but plan to return
- Did not attend and probably will not attend

What school(s) did you attend or are you attending?

Please tell us about your college major (or the one you have planned):

- Natural history-related
- Social Science (including education)
- Other STEM-related field
- Not STEM and not involving natural history
- Other, please explain:

What specifically was (is, will be) your college major?

Did you, have you, or will you be declaring a college minor

- yes
 no

Please tell us about your college minor (or the one you have planned):

- Natural history-related
 Social Science (including education)
 Other STEM-related field
 Not STEM, but involving natural history (e.g., musician who sings about climate change)
 Not STEM and not involving natural history

What specifically was (is, will be) your college minor?

How much did your YES! experience affect your choice of your college major?

- A great deal A lot A moderate amount A little None at all

Specifically, what was it about your YES! experience that affected your choice of college major?

How much did your YES! experience affect your choice of your college minor?

- A great deal A lot A moderate amount A little None at all

Specifically, what was it about your YES! experience that affected your choice of college minor?

Are you attending or did you attend graduate school?

- Attending
 Attended with no plans to return
 Planning to attend
 Graduated
 On leave, but plan to return
 Did not attend and probably will not attend

Please tell us about your graduate school field (or the one you have planned).

- Natural history-related
 Social Science (including education)
 Other STEM-related field
 Not STEM, but involving natural history (e.g., musician who sings about climate change)
 Not STEM and not involving natural history

Specifically, what is your graduate school field (or the one you plan)?

Please tell us about your career path (or the one you have planned):

- Natural history-related
 Social Science (including education)
 Other STEM-related field
 Not STEM, but involving natural history (e.g., musician who sings about climate change)
 Not STEM and not involving natural history

Specifically, what is your career path or what do you want it to be?

How much has your YES! experience affected your career choice or the career you plan to pursue?

- A great deal
 A lot
 A moderate amount
 A little
 None at all

Specifically, what was it about your YES! experience that affected your career choice?

Please tell us about the role of science in your life outside of academics or career. In what parts of your life does your STEM learning play an important role?

- Parenting

- Political activism
 Volunteering
 Hobbies
 Other, please describe
 No STEM involvement

How much did your YES! experience affect your involvement with STEM outside of school or career?

- A great deal
 A lot
 A moderate amount
 A little
 None at all

Specifically, what was it about your YES! experience that affected your STEM involvement beyond school and work ?

Outcome 1. Science related content or skill

This section is about your YES! experience and the specific skill(s) or knowledge you learned as a YES! intern. We would like to know how your YES! experience has helped you as a student; in your work; and in your life outside of these two realms.

What knowledge or skills from your YES! internship did you later use in school or college? Specifically, in what ways did you find them useful?

What knowledge or skills from your YES! internship have you later used in your work or career? Specifically, in what ways have you found them useful?

What knowledge or skills from your YES! internship have you used in your life outside of school or work? Specifically, in what way(s) have you found them useful?

Outcome#1. Interest in Science

This section of questions is about how your YES! experience affected your interests. It will take about fifteen minutes to complete. (If you are using your mobile phone to respond, turn it to landscape mode.)

The Venn diagrams below represent you (blue) and science (green). The images represent relationships that range from having no interest in or involvement with science (at the far left) to being totally identified and involved with science (on the far right). The middle image represents about half of your life involved with science and about half involved with non-science related interests and pursuits.

Please select the image that best represents your relationship to science BEFORE your YES! internship.



Please select the image that best represents your relationship to science NOW.



For the statements below, in the first column, please respond according to how much you agree or disagree with each statement. Select your response in the dropdown box. Then, in the second column, please rate how much you think your YES! experience contributed to the trait described by the statement.

	This statement describes me well.					How much did your YES! experience contribute to or support this trait?				
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Almost entirely	A lot	Somewhat	A bit	Not at all
I spend my free time trying to find out more about science or scientific topics.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think a lot about how my life is affected by science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have a lot of pride in the accomplishments of science and scientists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe I can be a successful scientist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	This statement describes me well.					How much did your YES! exper contribute to or support this tr				
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Almost entirely	A lot	Somewhat	A bit	Not at all
Solving complicated scientific problems interests me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am interested in reading websites, articles, or books about scientific issues.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communicating scientific topics to others is interesting to me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The logic/methods used in scientific fields are interesting to me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solving scientific problems is interesting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientific topics interest me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am interested in the way science can be used to help people.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am interested in the way science can be used to solve problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want to help others through science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Now we'd like to know a bit about your experience as a YES! intern. Please respond to the following statements:

In my experience as a YES! intern, generally speaking . . .

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
. . . I felt a sense of choice and freedom in the things I did.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . most of the time, I did things feeling like I did them "because I have to." (in contrast to "I want to.")	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I felt that the people I cared about also cared about me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I felt excluded from the group I wanted to belong to.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I felt confident that I could do things well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I felt serious doubts about whether I could do things well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
. . . I felt that my decisions reflected what I really wanted.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I felt forced to do many things I wouldn't otherwise choose to do.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I felt connected to other interns, staff, and researchers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I felt capable at what I was doing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I felt disappointed with many of my performances.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I felt pressured to do too many things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
... I had the impression that people I worked with disliked me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... I felt competent to achieve my goals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... I felt I was doing what really interests me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... I experienced a warm feeling with the people I worked with.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... I felt the relationships I had were just superficial.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... I felt like a failure because of the mistakes I made.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Outcome #2. Communication

This next section is about science communication. It will take less than 10 minutes to complete.

In what ways do you use your science communication skills? For each item below, please tell us how much you use each of these skills. Then please tell us how much your YES! experience contributed to your ability to use these skills.

	I currently use this skill ...	How much did your YES! internship contribute to your interest or awareness of the importance of using this skill?
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	I currently use this skill ...	How much did your YES! internship contribute to your interest or awareness of the importance of using this skill?
Explaining scientific concepts with everyday related examples.	<input type="text"/>	<input type="text"/>
Using maps, graphs, charts, or tables to understand a scientific explanation.	<input type="text"/>	<input type="text"/>
Using maps, graphs, charts, and tables to help listeners or readers understand my explanation.	<input type="text"/>	<input type="text"/>
Linking multiple maps, graphs, charts, or tables with each other to help listeners or readers understand my explanation.	<input type="text"/>	<input type="text"/>
Changing scientific language into everyday language	<input type="text"/>	<input type="text"/>
Giving concise answers to questions about scientific terms or definitions.	<input type="text"/>	<input type="text"/>
Listening patiently while someone finishes asking a question (even if I already know what they're asking before they're finished).	<input type="text"/>	<input type="text"/>
Asking a listener if they understood my explanations.	<input type="text"/>	<input type="text"/>
When I explain things, hearing and using the terms my listener is using.	<input type="text"/>	<input type="text"/>
Asking my listeners what they already know before I help them learn more.	<input type="text"/>	<input type="text"/>
Adjusting my explanation to what the listener already knows.	<input type="text"/>	<input type="text"/>
Using questions to help listeners discover things.	<input type="text"/>	<input type="text"/>
Using multiple objects or specimens to help listeners understand my explanation.	<input type="text"/>	<input type="text"/>

Today, in what ways do you apply your science communication skills?

Outcome #3. 21st Century Skills

This section is about YES! and your personal development. It will take about five minutes to complete.

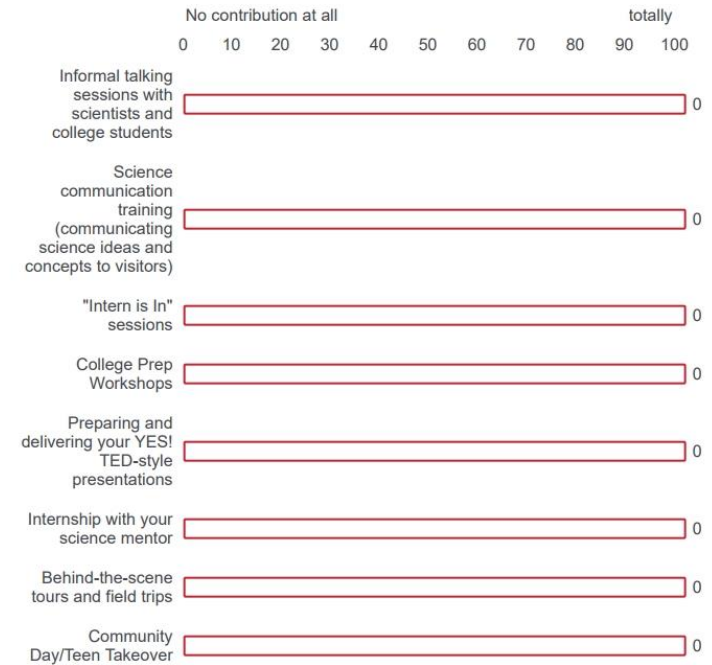
Looking back, how much do you think being a YES! intern contributed to your leadership skills and your sense of self?

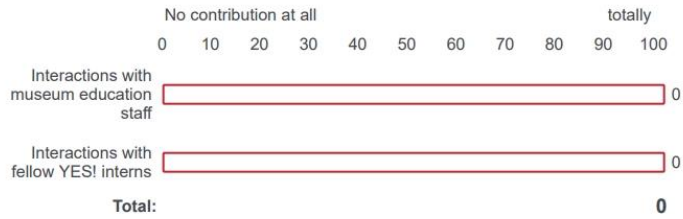
	A great deal	A lot	A moderate amount	A little	None at all
Being able to interact with adults.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to think about how my actions affect others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to tell other people about what I've learned.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to work as part of a team or group.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to share my thoughts and ideas with others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to be patient.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being confident to try new things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to accept responsibility.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being willing to take on a leadership role.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being willing to take care of the environment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seeing myself as part of nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

YES! Activities Contribution

Considering all the ways you changed and what you learned as a YES! intern, please rate the relative percentage each of the following YES! experiences contributed to your learning. If you don't recall the event or activity as part of your YES! internship assign "0".

Note: Your numbers need to add up to 100, you reach 100, new options will no longer be available. In that case, reduce scores you have already assigned.





For the three highest scoring activities, please describe how each impacted you and the reason you scored them highly.

Alumni Experience

This next section is about your alumni experience.

With approximately how many people from your cohort do you remain in contact?

- none
- one (please list)
- two (please list)
- three or four (please list)
- five or more

For what reasons would you maintain contact with your YES! intern colleagues?

- To maintain friendships
- To maintain a network for academic help

- To maintain a network for career advancement
- To help inform the program
- Out of curiosity about what they're doing
- Other
- I have no interest in staying in contact with YES! colleagues

Please list the names and positions of professionals (staff, researchers, etc.) with whom you remain in contact.

Please list the names and positions of professionals (staff, researchers, etc.) with whom you remain in contact.

For what reasons would you maintain contact with YES! staff ?

- To maintain friendships
- To maintain a network for academic help
- To maintain a network for career advancement
- To help inform the program
- Other

In what ways would you be willing to support current YES! interns?

- Advice and support applying to or planning for college
- Conduct college tours
- Share lessons learned from your YES! experience

- Share information about other opportunities at the Smithsonian
- Attend YES! presentation events
- Serve on career panels
- Other

How interested are you in participating in a support network for YES! alumni?

- A great deal
- A lot
- A moderate amount
- A little
- None at all

From the list that follows, please select the ways of alumni participation that interest you.

- facebook group
- other social media group
- alumni directory (what are you doing now, how to contact)
- alumni list serve
- alumni hangout/get together/ events
- none of the above

Would you be willing to share information about yourself (e.g., phone number, email address, current occupation, etc.) in an Alumni Directory?

- Yes
- No

What additional ideas do you have for keeping YES! Alumni involved with the YES! program?

Suggestions

What other conditions in your life affected the impact of your YES! experience?

What changes can you suggest that would have made your YES! experience have greater impact?

Thanks so much for completing this questionnaire!

Appendix B. The Interviews

F8 (2010). The Art of STEM (and Politics).

F8, a female 2010 YES! alum, attended a private research university in Washington, DC with a full scholarship. While she unfortunately had to take a leave of absence after her first year, her hope was to earn a degree in Anthropology with a minor in Art. She is currently an artist and a business owner.

She was selected to be interviewed because she had indicated that YES! had had a great impact on her choice of major and on her life outside of work and school. With regards to her choice of major she said that *“participating in YES! had a profound effect on me when I chose my college major. [In YES!] I had a closer look at all the sciences I was already interested in and found out what I wanted to focus on in my higher education.”* With regards to her life outside of work and school, she said *“I am still very passionate about science. I volunteer with Bernie Sanders and his plan to combat climate change, a topic I learned a lot about at the NMNH. A lot of my artwork is about natural science. I like to learn about the subjects of my paintings which are usually plants, animals and people.”*

F8 found out about YES! from a flyer and she knew she would enjoy the experience because she grew up around the Smithsonian Institution and had always loved science.

She said that YES! helped solidify for her that science was the direction that she wanted to go in. Doing the interactive teaching carts in the Hall of Human Origins, in particular, cemented her interest in anthropology specifically.

After YES! she received a full scholarship to a public research university in DC—largely, she believes, because of both the “legitimacy” that being involved in YES! conferred on her as well as her genuine passion for science. Unfortunately, due to personal circumstances, she had to take a leave of absence after her freshman year which ended her formal involvement in science. She does note, though, that had life not gotten in the way she would still be science. She said

One of the biggest disappointments to me was that I didn't finish [school and that] I also never satisfied or fulfilled that thirst for knowing or for learning science, especially, and not being around it to this day. Because those are some of the best days of my life interning.

Nevertheless, she was still able to transfer the interests and skills she had cultivated through YES! to her life. For example, she said her art is influenced by natural history, and when she does an art project she approaches it like a scientist:

“I think [YES!] definitely has influenced my art and that from being in the program I gained an appreciation for nature and the art that's in it. That's something I enjoy painting. Even when I'm working on something, I like to do some research and kind of approach it like a scientist would, so to speak, and kind of study the images and study what I can find and using reference material. I find high definition and high-resolution photographs of just flowers and different kinds of animals and plants and all of that. One theme around all of it to me that stuck out was just sort of the art in it. Just what I consider to be raw art and in science in general. Obviously I'm a very visual person and I think when you work in a museum in general, it's a lot that goes

into the visual aesthetic because it matters. I think that I definitely picked up on that.”

In addition, when she switched to teaching at Paint and Sip classes, she was able to bring over the communication skills she had gained from YES! to excel at this new line of work. She said,

“[i]f I didn't have a skill of being comfortable around strangers and around people and that was of course from the YES! program, then I wouldn't have really been able to be that great at what I was doing at that time....so much of [YES!] was just talking to people, all different sorts of people from different backgrounds, different ages and teaching them something, hoping that they'll remember that. Being in [a] sort of retail it's a strength of mine.”

Lastly, with regards to some of the political activism she is currently involved in, she says that her understanding of climate change came from YES!

I first learned about climate change through the program. I mean we talked about it in school, but it wasn't really that important. So working at the museum, I remember there was this big exhibit about climate change and about the oceans. I think it's still there, but it was something that I remembered first being introduced to and in a really informative way where it's I'm literally learning about the science from the scientists themselves working in the museum.

Gaining this knowledge through her experience during YES!, she was able to later apply it through volunteer opportunities, sharing information on climate change and why it's important today. While F8 didn't pursue a formal science career, her oeuvre and the aforementioned choices in volunteer opportunities illustrate her continued passion for science and the ability of YES! to build transferrable skills and science minded citizens.

F1 (2011). Sisters in STEM: Blazing a Path Forward for Herself and Others

F1 is a female 2011 YES! alum who attended an Ivy League college where she majored in applied economics with a minor in information science. She currently is working as a tech consultant with the hopes of ultimately going into product management. She was chosen to be interviewed for three reasons. First, prior to YES!, she reported her relationship to science as totally separate. After YES!, though, she described her identity as overlapping 40% with science. She also indicated that YES! had a high impact on her career choice; specifically, because it enabled her to understand how age is not a limit to having meaningful opportunities and built within her the confidence and desire to want to do more with her life trajectory. Finally, YES! also impacted her life outside of work and school motivating her to take on an invertebrate zoology research internship at the National Museum of Natural History during her senior year of high school and was selected and participated as one of the three students representing the USA at the 2014 millennial youth camp. For all these reasons, it was of interest to learn more about her story.

F1 was excited about the possibility of a YES! internship as it was a paid internship and at the Smithsonian, an institution with “a huge brand name.” To her, YES! was a great stepping stone that helped shape a new understanding of what she should could do in this world:

I've had internships since then [freshman year of high school]. It's honestly because when I applied to YES!, I never thought internships were a thing in high school, and after that internship I was like, 'I have to match this. I have to go above and beyond.' So I did.

After YES!, she went on to start her own nonprofit, start a nationwide community service program, start an online company, conduct research abroad, and participate in other internships ranging from Smithsonian-affiliated to corporate. She attributes her ability to do these things to YES! because the program not only increased her sense of self efficacy, but also conferred legitimacy through its reputation. She went as far as to note “...out of all the things that I've accomplished in my life, I truly credit the Smithsonian to that. I'm so grateful that I got into this thing.”

Aside from empowering her and enabling her to pursue additional opportunities and initiatives, F1 explained that YES! drove her into the STEM path. Going into YES! she did not have an understanding of what STEM was, but remembers being in the museum and seeing high level technology displays that sparked the thought of, “*Oh tech kind of looks cool, tech and science. Maybe I'll design some cool interfaces, for the museum or stuff like that.*” From there she explored engineering, math, and technology, but science and technology are what she stuck with.

After delving into the world of tech and gaining confidence in her understanding and place in the field, F1 reflected on her initial tech experience:

*I remember whenever I would go to a CS meetup [Computer Science] or whenever I was talking about other kids that were doing technology it was always guys, and guys in middle school and high school were very arrogant about knowing how to code. It wasn't even like they actually knew how to code. In hindsight, I'm just like, 'He knew how to write hello world.' I just remember feeling just so underpowered and just thinking that I was so stupid but then it's also, I did all these internships so why should I feel stupid that I don't know as much. So honestly I think YES! kind of got me into STEM but getting more involved...made me realize how much discrimination there is against women in technology. If anything I was like, "You know what, **** this." I've had so many other accomplishments. I should be advocating for women in STEM. There should be more women in tech, and the more we get women in tech earlier on, their age, the better it's going to be for this whole issue.*

Because of this, she has become involved in women in STEM outreach to create supportive networks for other women like her.

Through this outreach, her nonprofit, company, national community service program, and inspiring her sisters to pursue Smithsonian research, YES! impacted more than just F1. It empowered and enabled her to serve and inspire those around her so that the benefits of YES! did not end with her.

M1 (2012). Understanding, Utilizing, and Disseminating Resources to Forge a Science Career Path

M1, a male 2012 YES! alum, majored in Ecology and Evolutionary Biology at a private research university in New York. He is currently a PhD student in Tropical Ecology at a public research university in Maryland and hopes to pursue a career in research science.

He was selected to be interviewed because he indicated that YES! had had a great impact on his choice of major, his career choice, and his life outside of work and school, particularly his interest in STEM education and youth outreach. Additionally, he had gone on to participate in Natural History Research Experiences (NHRE) at NMNH after YES! during college, which was of great interest.

M1 found out about YES! from a friend he had known for a few years through school who thought he would be interested as M1 had always been interested in science. Beginning YES!, he never narrowed down what in particular he wanted to study in college or pursue as a career. After doing YES! 1.0 and YES! 2.0, which had a genetics focus, though, he went into college with a better understanding of what he wanted to study.

When it came to career choice, he said that more than the exact content it was science writing, the project, creating a poster, talking about his research, and working with different mentors who were actively doing research had the greatest impact:

the experience of being in a research setting and talking with mentors about my path through college and what I would do if I wanted to stick with science and do research and things like that definitely helped me.

Outside of career and academics, he says that YES! helped him make a few friends with whom he is still connected. It also helped him develop an independent relationship with DC. He also said he developed helpful skills such as public speaking and talking with people he did not know in a professional setting.

Regarding his involvement with NHRE, he explained YES!:

...Was probably a big part of the reason why I was able to even do the undergraduate NHRE program at the Smithsonian....I ended up working with the same mentor that I had in YES!, so I was in the bird strike lab. And so to be able to continue with that research and keep those connections going and those relationships going definitely helped me. And then just seeing the work environment at the Smithsonian from the YES! Program, I knew that it was a good place to be, a good place to work.

After YES!, he received a family foundation program grant to fund a festival. The first part of the program entailed attending an established festival in Aspen, Colorado. The second part was to host an event of his own. Due to his YES! experience he chose science outreach as his topic. Drawing from some of the science outreach experiences from YES!, he started doing science experiments in elementary schools. Then, when it came to putting on the final festival, he got help from some of the people he had worked with at the Smithsonian through YES!; namely they came to the festival and ran a few exhibitions for the kids. Through this festival, he was able to not only leverage the skills he learned from YES! but also pass on that experience to others so that it benefited more than just himself.

He mentioned that one of the best parts of YES! was that it gave opportunities to traditionally underserved and underrepresented groups. While he had come into the program interested in science, he said that “[for] some of my friends who I had met in the program, [...] that was the first time that they had ever seen or done anything like that, been presented with science as fun or interesting or anything like that.”

Thinking about the science outreach he himself does, he said

It's still even something that I see today in the area with some of the work that I do with children, especially [...] in the Southeast DC, Northeast DC area, that this area [...] has all of these organizations: NASA, Smithsonian, NIH, NSF, that the people who are from here don't really have access to a lot of that. So I mean, as a program for anyone who participates in it, I think is great. And if more people could participate in it then I think that's the only thing that could make it even better, is having even more chances for students to be involved.

M3 (2013). Metamorphosis of a Scientific Illustrator

M3, a male 2013 YES! alum, studied Biological Sciences at a public research university in Maryland. He is currently pursuing a Masters in Medical and Biological Illustration at a private research university in Maryland in hopes of pursuing a career in medical and biological illustration.

He was selected for an interview because he indicated that YES! had a high impact on his choice of major, career choice, and life outside of school and work. For example, regarding his career choice he said:

While working at the insect zoo, I became comfortable in teaching people about the importance of insects. This communication skill grew to lead me into the world of education using visual media."

He found out about YES! because his cousin had been a part of the first cohort and frequently spoke about the program and what a great experience it had been. She encouraged him to pursue the opportunity as well, so he applied to YES!.

When he described the person he was before YES! and the person he was after, he said, *"before I went [through] YES!, I just stayed home all summer, played video games, didn't really push myself to have an end goal"* and was shy. Then, after going through the science communication training, he developed the confidence and sense of self efficacy he needed to actually go out and educate people himself. The training not only taught him how to speak to and educate large audiences, but also gave him experience in doing so. YES! also taught him social skills that enabled him to build long-standing friendships and more confidently communicate with others about his experience and skills in a professional context. Most importantly, though, he says YES! *"gave me a wake up call that life is serious. It matters. Every decision you make from now on, will impact where you end up. [I]t really opened my eyes to the real world."*

In addition to cultivating this skill set and sense of self efficacy, the YES! program experiences and M3's project content also helped him understand that he wanted to go into medical illustration and science education. More specifically, through the program's field trips, he got to see science education outside of the museum. He said this exposure in conjunction with opportunities throughout his internship to step into the role of a science educator *"really influenced me, because I never envisioned myself as an educator until I started educating people"* and that *"[this] drove my attitude to kind of change perspectives on what I really want to do in the future."*

M3 also developed a greater understanding of and appreciation for science education while interning in the Insect Zoo.

And learning about the importance of insects, and really getting to know their impact on the environment, really drew my interest towards things like preservation, and kind of understanding that climate change is real, it's happening. It's affecting not only animals, but insects as well, and affecting the small biomes.

This understanding of the importance of insects and their relativity to our lives solidified his desire to pursue a career in science education.

YES! not only cultivated a new interest for M3 in science education, but also strengthened pre-existing interests in art and science. Through his YES! internship and gaining a greater awareness of the variety of science related careers at the National Museum of Natural History he was able to seek out connecting with a botanical illustrator at NMNH who helped solidify his desire to pursue medical illustration.

...There's actually a person that works at the museum, her name is Alice Tangerini, and she's a botanical illustrator, and she still works there, and I had no idea who she was during my time there. But after I left and I was getting ready to apply to master's programs, I got in touch with her, and she was so full of passion towards her career, and what she did. And just looking back at her legacy, she showed me all of these illustrations, they were just so inspirational. It was then when I really knew what I really wanted to do.

F10 (2013). The Good Fight: Making Science Accessible through Formal Education

F10, a female 2013 YES! alum, attended a national women's liberal arts college for her undergraduate degree in Biology. She is currently seeking a Master's in Education from an Ivy League school in hopes of pursuing a career in either science teaching, STEM program development, or STEM curriculum development.

She was selected to be interviewed because she indicated that YES! had a large effect on her career choice and life outside of school and work. Regarding her career, she said, *"the flexibility and exposure to different fields of STEM at the museum and the zoo helped me see what I potentially wanted to do, and what I realized didn't work for me."* With regards to her life beyond school and work she said, *"YES! allowed me to see that STEM can be done professionally or casually. I could find enjoyment in STEM that was just for me, and for fun."*

She was interested in YES! because she wanted to understand what scientists do and develop skills that would serve her in a professional context. Since YES! was a high school internship, which was a novel concept to her, and afforded a variety of experiences, she applied. While she was interested in science going into YES!, she came into the program with misconceptions about science. She said:

I think at the time [before YES!] I knew I wanted to do science, but I wasn't quite sure what that was going to look like. And I think I also had the narrow mindset of, it was only about medicine." However, after YES! "I realized that one, there's so many more aspects to science than I initially realized and that I can use the skills that I've learned from YES!, or even just from my scientific training, in various different fields like teaching and education. So I think post YES! it's been, "how do I take what I've learned and applied in different contexts?"

Thus, YES! not only taught her that science goes beyond the field of medicine, but that science skills can be transferred to fields like education.

She said that when it came to sparking her interest in science, YES! was so impactful because she got the opportunity to see science at different locations (both NMNH and the zoo) and *"the opportunity to do scientific research in a way that was different than what I was doing in my high school classes."* As a result, she now tries to bring these unique experiences, which had sparked her interest in science, to her own students.

She's also passionate about bringing her YES! experience to her own students because she sees it as a means of combating the inaccessibility of science. She said that she became interested in the issue of access *"because I didn't necessarily have that access. Even though I'm from Northern Virginia [and] D.C. is really close for my family, it was very difficult to go to museums."* However, YES! was able to afford her experiences she otherwise wouldn't have access to. As a result, she wants to go into formal education in order *"to make sure that students are able to access some of the activities I was only able to really get when I came into YES!"*

Outside of developing her career interests, YES! helped her become a more confident public speaker. She said:

I think having to do a lot of public speaking and engaging with people, that was a big step for me because I mean I teach now and I can talk a lot, but at the time I was really hesitant to do public speaking and I did have the personality for it, but I wasn't really comfortable with it. So it made me more confident in that sense of being able to talk to anybody.

She mentioned the cart activity being particularly useful in developing this skill:

You have to be like [you were presenting with] the carts when we were interns. So, you really have to literally talk to anyone and engage and find a connection to them and what they're here for and why they should learn about different animals, objects, issues in society.

She also said she learned how to be a mentor in part due to her YES! mentor being such a great mentor. She said that her mentor was impactful because she was supportive and helped her see that she was actually contributing no matter how small her role was. This helped her ultimately understand that projects boil down to teamwork.

When asked specifically if there were ways that the YES! internship impacted her life outside of her career and academic trajectory, she said it has been good to see where others in her cohort and past cohorts are regarding their academic careers. She said that while a lot of them came in thinking they'd become scientists, it was nice to see people branch out and that that branching out was okay. She said:

It's still good to see the same work ethic that we had when we were in [YES!] the program. Those were things that carried us through and even if we all decided to not end up in science, there are still valuable things that we learned that we kept with us."

Lastly, she mentioned that exposure to the topic of climate change through the field trips and talks with scientists during YES! played into the motivation behind her current political activism.

F6 (2013). A Sense of Self in Diversity

F6, a female 2013 YES! alum, recently graduated from a private university in Washington, DC where she majored in Community Education with a concentration in Mathematics. She currently works in social services as a youth development worker. She hopes to go to graduate school for either mathematics, social work, or education in order to ultimately pursue a career in either education or social services.

She was selected to be interviewed because she indicated that YES! had a great impact on her choice of major and career. Regarding her choice of major she said, "the YES! program helped me realize that I want to work with youth and with a similar program like YES!. So I decided to go into Education, Advocacy, and Social Work. My college had a major that combined all of these in one major; Community Education." Regarding her career choice she said:

[T]he YES! Program exposed me to many STEM Fields, and also many college related topics. Exposing me to an environment I never really thought that I would be a part of. My friend enjoyed the program so much and it helped me realize that I wanted to have the same impact on youth someday, as the YES! Program had on me and my friends.

Moreover, her story was of particular interest because she now works with a nonprofit organization that provides medical, social, and educational services, and is a YES! community partner.

Even though she originally did not want to do YES!, as she did not know what she wanted to do with her life and she thought YES! was a huge time commitment, she chose to do it because one of the development workers at the non-profit she currently works at told her that it was a great opportunity to meet youth who were different from her and to be exposed to different fields. This advice proved to be accurate. When asked about her YES! experience she said that one of the reasons YES! was so impactful was due to the diversity of the program's interns. When contrasting her YES! experience with her experiences with other programs, she said:

I think what was unique about my experience with YES! was just that it put me in a different environment...It's just the diverse background, because a lot of the other programs, it was [the] same type of kids in DC or same type of issues. But YES! was more academic and also it involved different faces. You just didn't see, like I said, just DC kids. You saw kids from Virginia, Maryland, and different cultural backgrounds, and I'd never seen that before, because like I said, I went to public school. All the kids in public school were from DC and they looked like me, and then you had these other programs that were in DC that involved the same kids in DC.

Moreover, she said that she learned from YES! that she did not have to be intimidated around those of a higher socioeconomic status. When reflecting on her experience going to more formal NMNH events through YES!, she said:

I would think it's a fancy thing and I thought I would be very out of place with so many different people who are in business, who are very up in the ladder. Because I grew up in DC and went to public school [...] I wasn't really exposed to people who were different from me face wise and maybe socioeconomically... So, I never really thought that I would be able to thrive in a place [like that], because I thought it would feel very uncomfortable, very out of place. I think in the beginning I did feel like that, but sooner or later, I realized that I can adapt to different environments...Or just in the cohort, too. There were a lot of different kids from different backgrounds, so I thought I would be like I'd be out of place, but I actually bonded with them, too.

She went on to explain that learning she can adapt to different environments really helps with her current role:

I work at a nonprofit, so they have galas and different things where I have to talk to different people who donate money to us, and in the beginning, I feel like I always felt like I can't talk to people like that, because I don't know what I'm going to talk about. But having that exposure in YES! also helps me a lot nowadays too, because I'm able to manage that environment and things like that.

In addition to benefiting from interacting with those different from herself, she also benefited interacting with those similar to herself. For example, she said that her Latina mentor's candor about diversity really helped her understand her own place in the field:

I just love her sincerity about the field, and she was very sincere about answering my questions about diversity and things. Because I did ask her how she felt sometimes with being in this field. Because I did ask her sometimes did she feel different? Because when I was that age, I sometimes did feel like that, because it was just a lot of things about my dad not wanting me to do certain things. So, I just asked her professionally, how does she feel? I just loved her sincerity about it, about how she felt about her job, her field, and just being at the museum sometimes.

With regards to her career, she said that YES! helped inspire her career in youth programs. She said:

...so when YES! was over, I kind of asked the person in charge. I asked him how he got involved in youth programs, and he explained to me a lot about college, and that

exposure just helped me realize that I love those types of environments. Because he helped me a lot, and the program just helped me a lot. And so when I got to college... I started volunteering here [at the non-profit she currently works at]. It just reminded me of that...I want to create an environment like that for other kids to help other youth. And so slowly, I just started to get interested in that, youth programs and just having the same impact that those programs had on me, on other youth, because I feel like that's so important for youth to find a way. I had a lot of issues when I was younger, so if I didn't have programs like this to help me on my way, I don't know what would've happened. But I want to be able to expose that to other youth, so slowly in college, I tried a lot of different things in the beginning, but I ended up working at a youth program, too.

Moreover, growing up, she had always been discouraged from doing math because none of her friends were pursuing math and her dad would ask her what she would do with a math degree:

A lot of my friends wanted to do different [things], like criminology, criminal justice, and all these other things. So...I kind of got discouraged, because a lot of people would be like, "Why do you like math?" Or my dad will always tell me like, "What are you going to do with that?" And I didn't know what I was going to do with it."

However, thanks to YES!, she was able to see what scientists did and what a career like that would look like if she stuck with it, which made her more confident pursuing math:

I think it reassured it [me], because I didn't have a lot of programs that focused on STEM when I was younger. So, it just reassured me that it's fine. You can do this. [...] Because I saw scientists who actually were what they studied. [...] So, I liked that. It just reassured me that I was good in this, that it was okay, and that I could do it.

Moreover, having a Latina mentor helped her see that people like her could have successful careers in these fields:

Because my mentor, she was a scientist and she was Latina. So, I was just like, "Oh, my God. I can do this." I don't see a lot of people that look like me doing stuff like that. So, I was really excited.

Furthermore, through YES! she was exposed to other fields, such as botany, and she was able to see her heart really laid with math:

So, I've always loved math. Math was just the only thing I was good [at], because I was really bad at English and all these other things. I like science too, but math was just something that stood out.

Regarding her experience with the people involved in YES!, both interns and staff, she said she loved the program staff because they were nice and didn't play favorites. She also said that she was able to bond with them because they had similar backgrounds to her. When reflecting on her cohort and the staff she said:

The cohort I was part of was very diverse. So, you had Latinos, you had African Americans, and you also had white. And the people who were in charge of my cohort, they also had similar backgrounds, so they were Latinos and they were just people of color. So, they were very relatable in the [that] aspect. They also grew up in DC, so I feel like a lot of the kids in general were able to play around, or they were [able to] understand them better, just because they had this similar background. So, I think that's what made it very good, because it was fun. You could tell them things and they'd be like, 'Yeah, when I was younger...' It was such a good bond. We were able to create a good bond with them, and I loved that.

When asked specifically why she was able to connect so well with the staff, she spoke about the director and said:

I think it was just the fact that, one, he was also the same background as me, but also just the fact that he was very fun-loving, very dynamic, very sincere, too and open to everybody, and you could tell he enjoyed what he did. So, I think everybody really liked that energy...[The other head] was the same and I just felt like you could feel like they cared. So, I think that was a big thing too. You could feel like they liked what they did, and they cared a lot. So, I had the best experience with them, so I think that's why."

She also spoke to feeling like her cohort was like a family and that these relationships helped her become better at connecting with others. When reflecting on her time with them, she said:

I [would] be very excited to see my friends and to feel that energy of family. Because for me, it was like that. For me, it was like a little family. Even on the weekends when we would get together, it would be really fun. I would give up my weekend for it, and my friends, some [of] us became friends outside of the program, so we would do different things together. I just love the sense family and friendship that it gave, outside of just the academically [based relationships]. It just helped me become better at making friends, at making connections. It was super fun. I love all the people that I met from it.

Finally, when she looks back on the program, she remembers taking a lot of pride in having been a part of YES!. She said,

You know how sometimes you're very excited to tell others that you do [a] program. ... I was really happy to tell everybody I was doing this program. The fact that I could add it to my resume. [...] When I was younger, I was really happy to be a part of this."

M2 (2014). Pursuing a Staircase of Opportunity at NMNH

M2, a male 2014 YES! alum and currently enrolled at a public research university, is pursuing an undergraduate degree in Environmental Science with a concentration in Ecology and Wildlife Management and a minor in Geographical Information Science. He hopes to attend graduate school for either Environmental Science, Ecology, or Geographical Information Science in order to ultimately pursue a career in either biology or marine biology.

He was selected to be interviewed because he is currently working at NMNH, he mentioned that there was more that he had to say that he was unable to convey in the survey, and he indicated that YES! had a great impact on his choice of major, career choice, and life outside of both work and school. Specifically, he mentioned, *“In YES!, I was able to develop natural curiosities about things I would have never thought of before doing the program.”*

He found out about YES! from someone working at the NMNH gift shop who saw him with his family and thought he'd be interested. He then went on to do YES! 2.0 and YES! 3.0 because he looked up to those who were doing it and wanted to be like them. He said,

I just wanted to progress. I think it was also kind of competitive for me because [...] when I was in the first YES! program, I looked up to all the people at genome [YES 2.0] and I don't think there even was a 3.0 at the time. So I basically just looked up to all the people at genome and I felt like I really wanted to be in that spot where they were and I really just wanted to excel in the type of science that, or the type of biology that I could possibly go into.

One of the earliest impacts of YES! was in making him more science minded and a sparked interest in field research. When he was offered the opportunity to go on a high school research field trip, he chose the option to visit the Amazon. When asked if YES! impacted this choice, he said that:

[YES!] influenced me in a way that I've thought more scientifically about things and [...] viewed biology in a more aesthetic way. Before the YES! program I had never done that many hands-on things and so when I got that experience at the Smithsonian the first time I was like, "I kind of want to do this more." And so I felt like going into the Amazon and actually getting the chance to do real field work, felt like that would be a pretty amazing thing to be able to do.

Then, when he did YES! 2.0 and worked on the genome project, he realized that his interests went beyond paleobiology. He said:

Coming into the first YES! program, I was all paleontology, all paleobiology, like, 'Dinosaurs, yeah.' And it was cool. I love that stuff. But going into genome [YES! 2.0], I realized that I really have an interest in molecular biology and cellular biology and just getting into the nitty gritty of all that stuff [...] sort of shifted my interests from ancient biology, like paleontology, to that molecular aspect... after doing YES! 3.0, working with marine invertebrates again, after having worked with sponges and the genome, I don't know, it just, it kind of lit a little spark. And then ever since then it's just been the same. I just kind of want to progress in that field, in that direction.

As a result, over the course of his involvement in YES! his science interests completely changed from paleontology to marine biology, which is especially impressive given that going into YES! he did not know invertebrate zoology (his YES! 3.0 project) encompassed marine biology.

With this new research interest and experience working at NMNH, he continued to work up the ladder at NMNH and still does research today at NMNH as an undergrad. He said:

I pretty much just worked my way up the ladder, honestly. Yeah, like the first YES! program, I think I made a pretty good impression on the people. And made them curious as well. And I sort of did that, and then did genome, and then after that I was only one of the few people that applied to the YES! 3.0 program. So I did that, and then I just kept making connections, honestly. And then, that's sort of how I was able to land this past internship. Because yeah, it's like if you have a spot here, like if you have a spot anywhere, why take that for granted.

Outside of impacting his academic and career pursuits, he says YES! helped him develop social skills, friendships, and more motivation. He said:

It taught me a lot about just socializing. And I wasn't antisocial, but it just gave me more friends, more people to talk to. Definitely gave me more motivation, academically. Because everybody in that YES! program were really smart and they pushed me to strive for better grades and, I don't know, focus myself and apply myself. Yeah. I'd say that that's like the other major thing, just making new friends, developing those connections with people.

F5 (2015). Paying It Forward: Starting a YES-like non-profit.

F5, a female YES! alum from the 2015 cohort, attended a community college in Virginia double majoring in Ethnobotany and Anthropology and minoring in Linguistics. She currently works as an Electrical Engineering Engineer Assistant, but hopes to go to graduate school for Sociocultural Anthropology in order to ultimately pursue a career in cultural preservation as either a museum curator or research analyst.

She was selected for an interview because she indicated that YES! had a great impact on her choice of college major, choice of college minor, career choice, and life beyond work and school. For example, regarding her life outside of work and school, she said:

Thanks to the YES! program, I was able to create connections with other people like me. Two years after participating in this program I was able to help create a Non-Profit Organization called 'Your Girl for Good' alongside with some YES! Alumni. This program's target audience is specifically for young minority women in the DMV area, that have an interest in STEM, Arts, and Politics. For our first summit we were able to host some scientists from the Smithsonian Museum of Natural History. This program created such a huge impact in my life that without it, I don't think I would have been able to have the confidence, knowledge, and willpower to help people with a will to learn. Being able to help the community and help motivate others who may be struggling, has created a motivated individual with a world view that will never stop helping others to believe that education is amazing.

Because F5's parents did not finish high school, they always told her to take advantage of every opportunity that came her way. Thus, when she found YES! through her friend who had done YES! the year before, she applied. She spent the whole application process thinking that she would not get in and when she did get in, she could not believe it.

She said that because she grew up around nature in Oregon, reading Natural Geographic magazines, she always knew that she was interested in science. However, because her parents did not go to college, she was unsure of how to formally pursue science. As a result, she said one way YES! benefitted her was its mentorship. Specifically, YES! gave her mentors who were able to answer questions about next steps.

More than just elucidating next steps, she said YES! gave her the opportunity to see and learn from people who looked like her. She said getting to see people in the museum who looked like her and speak with them about their experiences and all the things they were doing helped her see “[t]his can actually be it [a career]. This sounds awesome.” She also mentioned that the people running YES! had similar backgrounds to her as well. Not only was there staff that looked like her, but there was also staff whose parents had not gone to college either. She said, “we connected in that [our parents didn’t go to college] and just being a minority in the science field or in any institutions like the Smithsonian. It was really interesting to see people that I could relate to” and that this was really helpful.

Additionally, she said the staff, mentors, and YES! experience as a whole, taught her there is always a support network available to help you get where you want to go in life. She said:

Personally it just helped me as a person to understand that following your interests can take you to a positive place. I've met a few people in the program where they didn't really have a lot of parental support. And after the program they were able to find a mentor and they treated them as family at the end of the program. So personally I would just say support's always welcome to anyone's life, whether it being friendship or mentorship. I would say that was the personal way that I was affected.

When asked specifically how YES! impacted her career, she explained that YES! helped her better understand what science is and that she wanted to do it. She said:

Career-wise, it just helped me see the daily routine of someone working in a place where I would like to see myself. I would say [that YES!] totally guided me to see and changed my thought of what science is. Because usually you think a scientist is always in a laboratory or digging up bones, but they have the different perspectives of office, field and lab. So I guess you can say that is the way career-wise it sort of shifted me and it made me think, 'Wow this is like an actual opportunity and I could totally see myself doing this in a few years.'

In addition to leveling the playing field, YES! helped her develop communication skills, technical skills. She said before YES! she was a lot shyer, but that the visitor engagement opportunities encouraged her to open up more:

Visitor engagement was one of the huge things because we would be able to talk to people from all over the world visiting the museum. So it sort of makes you comfortable talking to strangers and I feel like I definitely needed that because I just sucked at talking and it was always difficult for me to communicate with others, especially if I didn't know them.

These communication skills have helped her in her current role as she often makes calls and is frequently involved in meetings. She also said that the technical skills she learned through YES! specifically working through the different databases, has helped prepare her for her current role.

Most importantly, YES! not only taught her not to be scared to fail, but also helped combat her “imposter syndrome.” She said that, before YES!, “I was always scared to try a new application or be scared to fail. But now I’m sort of like, ‘Okay, if I fail I can try and do better next time.’” She also mentioned that through YES!:

I met a lot of people with PhDs and all sorts of degrees and achievements and that was just a real push for me because I always had very low confidence and I have imposter syndrome, where you compare yourself to what other people have achieved. And that sort of pushes you down and stuff like that. I always doubted myself before the program. I guess you can say over the summer, because I was going into my senior year, it sort of changed me because I was in a low confidence, low self esteem phase that everyone goes through in high school. So I guess you'd say that just really pushed me to think differently and have a more positive mindset.

With all these experiences, tools, and attitudinal shifts, after YES!, she was ultimately able to take on the issue of access within her community and start a nonprofit with people from her cohort, including F7. She said that having benefited so much from the YES! program she, and the other women from YES! who she started the nonprofit with, wanted to pay it forward:

When a door opens for you, you want to do the same for someone else and be able to give them an opportunity like yours and just to see other people that could have been you in the same position.”

The goal of the nonprofit was to get minority girls into STEM and political activism. She said that they got all of the ideas from YES! and even got a lot of support from past mentors. Some of those mentors even went as far as volunteering to be speakers at the program’s summits and taking on a mentorship role with some of the participants. When reflecting on the nonprofit she said, “*Creating an impact in someone else’s life and seeing it truly help them is great.*”

F7 (2015). Identifying Stereotypes and Redefining Roles in STEM

F7, a 2015 female YES! alum, is currently enrolled at a public research university in Michigan, majoring in Business and minoring in Computer Science. She hopes to go to graduate school for either Computer Science or Business Administration in order to ultimately pursue a career as a consultant.

She was selected to be interviewed because she indicated that YES! had a large impact on her choice of major, choice of minor, career choice, and life outside of school and work, specifically that “[i]t made me realize how we need more women in STEM so I am involved with programs that advocate for more female exposure.”

Applying for the program, F7 noted that many of her family members did not complete their formal education. This educational background and the support of her family helped craft a better understanding of the value of education and an ambition to pursue her own academic interests. Coming from this experience, she didn't think she would be able to get this internship.

When asked about her YES! experience, she explained that YES! helped challenge her idea of who did what jobs. When referring to a man she worked with during her internship, she said:

he was just such a big guy and you would never expect him to have that job where he was watering flowers and taking care of plants. And I think for me that's why it was so memorable because he wasn't the person you would expect in this job, but he loved his job, and he was really passionate about horticulture, which made it a fun experience.

However, her experience at NMNH did show her that, while there were certain fields of science that have female representation, there are many others that do not. This realization, in conjunction with the opportunity to meet so many women in STEM, an opportunity she would not have had if not for YES!, cultivated her interest in women in STEM.

In addition to opening her eyes to new interests, YES! helped her open up and enabled her to make friends with her fellow interns, friends who she remains in touch with and enjoys seeing. A few of her friendships from YES! were so strong that when one of them started a nonprofit, she joined out of desire to help them out. The nonprofit focused on promoting women in STEM, an interest of hers cultivated by YES! Ultimately, she helped create the nonprofit, which she had initially joined out of solidarity. Regarding the nonprofit she said:

"At first I thought that...I just thought like I just wanted to help my friends, but then actually seeing it grow, and then also seeing the impacts on girls' lives... it's hard not to help when you see things like that."

YES! also helped her better understand finances and what university is like and why getting an education is important. When discussing elements and lessons of the program that were influential, she mentioned that "after the internship, I think I became better with money where I had to create a bank account to get direct deposits." From a college visit organized through the program, she said that she got a better idea of what a campus looks like and what a university as a whole is like. Moreover, through YES!, she got to see just where an education can get you. She said, "I come from a low income high school where like a lot of us don't graduate or even go to university. So seeing this is what an education gets you, where you can work in cool places, and do what you love and get paid for it. It was a really cool thing to see." Gaining this understanding of the way education can support professional pursuits, YES! reinforced why she wanted to do well in school.

F2 (2016). Building Effective Ways to Deconstruct Perceived Barriers

F2, a female 2016 YES! alum, is a double major in Chemical Engineering and Anthropology and minored in Behavior and Community Health. She currently works as a chemical engineer, but she hopes to pursue an MD/PhD in Anthropology.

She was selected to be interviewed because she indicated that YES! had a great impact on her choice of major, her career choice, and her life outside of school and work. Additionally, she noted in her questionnaire responses “I could write an extensive piece about how YES! literally changed my life for the better, but I am time-restricted [right] now.”

Before YES!, F2 was a straight-A student who loved biology. She discovered YES! online when she was looking for science internships. While the deadline for the upcoming summer had passed, she decided to bookmark the website and apply, interviewed and was accepted the following year.

During her first few days in the program, she was excited by the novelty of the experience and impressed by how warm and welcoming everyone was. Reflecting on that time she said:

...Everybody's just so warm. And I'm like, 'Wow, this is something new to me. Something new that I've experienced.' Well, obviously, it's my first internship, but I didn't realize, 'Wow, this is going to be amazing.' And so, the summer starts and the first day it's... you're already welcomed. Everybody knows your name already. And I'm like, "What in the world?" Obviously the students don't know your name but the staff knows your name. As I walked through the class doors, Dawn was like, 'Hey, [F2]. Come on in.' And I was like, 'What?' This is just mind boggling to me. As a 16-year-old, somebody knows your name. In school, people don't know your name like that. And I went to a small school. But, still, it takes time. Right? So I think that's something. I don't know whose idea that was to remember everybody's name. But I think that was a great point.

In addition to being warm and welcoming, she noted that her YES! cohort was regionally diverse with a range of personalities and experiences and that the staff did a great job managing all the personalities. To this end, she also mentioned she greatly enjoyed the Bootcamp activities that constituted the first week of the YES! program.

When asked to describe the person she was before YES!, she explained that she loved medicine, but did not know much about biology or science as a whole:

Before YES!, I didn't know too much about bio. I was [planning on] pre-med. I've always loved medicine, and I'm still going to pursue medicine. But YES! just taught me that there's so much more to science.

She also mentioned that because she comes from a disadvantaged, low income background, she was never exposed to fields like paleontology and paleobiology. As a result, she appreciated that YES! exposed her to such a wide range of fields:

[M]aybe it was just my high school. I was very bio focused, but very pre-med bio focused. And YES! just had everything. It had things about space. I don't think I ever learned about space besides one chapter in middle school, and some [interns] did things at NASA and they were able to bring that knowledge back. So I think that we're

out in our little fields and we're becoming experts in our fields. And then being able to bring that back into our group was just awesome.

F2's positive YES! experience was also due to the project mentors, and the social and professional support networks developed by the program. When asked about her project mentor's role and effectiveness, she replied:

I think...their belief in me. I think it's that simple. I think that YES! did a great job at choosing mentors that really wanted to help people... they gave me autonomy. They were like, "No, you can know this. Let me teach you first...you're an expert now. You're almost me." And I'm like... What? I can do this? I can do research? I can present that research? My research matters? The time that I spent in the lab is useful data? This data you will use later on in your studies in your paper?... I think that was important.

The people in and associated with the program also helped create a strong professional and personal support network. Through YES!, the interns gained the opportunity to visit and tour a large government medical research center. Based upon this experience and forming connections with the staff present, F2 was able to network and learn about potential internship opportunities at this research institution. Interns also had the opportunity to get to know their cohort members throughout the program. The YES! structure whereby interns worked with a partner intern during their project encouraged them to collaborate and debrief about projects together. Time spent with cohort members was especially important to F2, as she built strong friendships that remain strong today.

In addition to appreciating the opportunity to be exposed to a variety of fields, she also appreciated the opportunity to try on many hats, such as science educator. When reflecting on the experience of teaching museum visitors how to pipette, she said:

I was able to teach somebody things and I've never had the opportunity to teach something like these random museum visitors thanked me.... adults that ... would have never touched a pipette had they not come into the museum. Because I don't think when you go to museums you get the bio thing. You usually see dinosaurs, and you see animals, and stuff like that. But you don't get like that biology type of stuff. So that was awesome.

Other hats she was able to try on were that of teen scientist and expert. Through gaining a new understanding that there was more to the museum than met the eye - that there was research going on in the wings - she was also able to picture herself as a teen scientist:

I think museum programs are important because before then I would visit museums, but I didn't realize that there's a whole other world to museums, like behind what you see. It's like when you see so many things and cases, and stuff like that. But it's like, 'Wow. There's actual research going on. There's actual scientists.' And I, as a teenager, [I] can become a teen scientist. That idea, for me, was revolutionary.

This YES! 1.0 experience also equipped her to better navigate the city and utilize public transportation options. "[i]t changed my life because it's my first time in D.C. Like my first time

riding the Metro.” As a high school student residing in Maryland, this opportunity enabled her to gain a greater sense of independence. This greater sense of independence perhaps enabled and encouraged her to continue seeking out additional related internships. She applied for and participated in the YES! 2.0 internship experience the following summer, and after that interned at a large medical research center. These subsequent internships strengthened and solidified her preexisting interest in biology, her sense of self efficacy regarding a science related path, and her identity as a teen scientist.

When asked how all these YES! experiences and opportunities impacted her academic trajectory, she explained YES! is why she is pursuing a double major in Anthropology and Chemical Engineering. With regards to anthropology, she said YES! is where she was introduced to and fell in love with anthropology:

Before [YES!], I didn't know what anthropology was. I loved people and I love cultures but I couldn't put a name to it. YES! was able to teach me that, 'Oh. Hey, this is anthropology. This is a field. This is what cultural anthropology is. This is social anthropology.'

She went on to say that in learning about anthropology through YES!, she learned about Papua New Guinea and that she proceeded to fall further in love with anthropology due to it enabling her to connect with others better:

I learned so much about Papua New Guinean culture and then I met this family, this missionary family, that was from Papua New Guinea. And so I was able to tell them... I was able to relate on a whole new level because I knew things about Papua New Guinea that nobody would have known had they not been in Papua New Guinea. And I just learned it because I decided to pursue an internship and actually like learning things.

When it then came around to deciding what to major in she said, “I had to do something that I was passionate, like fully passionate in things that I had experience. And so I was like, ‘I have to do anthropology.’”

In addition to influencing her desire to pursue a Bachelor’s in Anthropology, YES! also drove her to want to pursue a MD/PhD in Anthropology. She said:

Our first year, there was a talk, I don't even remember the lady's name. [...] [S]he had a friend that was doing [an] MD/PhD in anthropology...her talk blew my mind. I was like, 'What in the world? You can study the things that you learn in the museum and apply it to help people?' To help people like in medicine, like I had always wanted to do. And I was like, 'Yeah, I'm sold. This is what I'm going to do forever.' And so, yeah, I decided to do it and [what] I love in anthropology....Everything in the museum that I loved [involved] anthropology and I'm still loving it in my classes. I love exploring people's culture. Learning about people and why they do the things they do. Just culture is so rich. So I have to balance out the hard STEM classes and just all that. It takes so much hard brain power to do engineering. And so, for me anthropology [...] just comes easier to me and it's just so beautiful because you can actually relate to people. But in anthropology, and all the other social sciences, people are the most

important thing. So I was like, 'I have to continue that.' And that's why I decided to do that.

Regarding her other major, chemical engineering, she said YES! contributed to her pursuit of it in that she met a lot of people at NMNH who did engineering, and having done YES!, she felt she could do anything:

JP did chemical engineering. In my mind, when I first heard that, I was like, 'Oh, wow. JP did that.' Like, 'Oh, I should do that. That's so cool.' And so, just connections through the museum... different people did engineering and were working at the museum. And I was like, 'Wow. I've explored paleobiology. I've learned about anthropology... And so I was like, 'Okay, I've explored that. Let me try engineering.'

Then, when as part of YES!, she visited the University of Maryland, she said to herself:

"Yeah, why not do it? I've never done engineering. I tried something new with YES and I loved it. Let me try engineering.' So it was kind of on a whim. I was like, 'Let me do chemical engineering.'"

When asked specifically what made her take a leap of faith on majoring in chemical engineering, she said:

Taking a leap of faith at YES!. Knowing that I didn't know anything about anything. I didn't know anything about engineering. [...] My YES! experience was able to teach me that I could've known nothing about something and still be good at it. [...] So that's the same thing. For me, it was like, 'Oh. Let me do... I've heard of chemical engineering.' I looked at all the engineering because I wanted to do engineering because that's something that I hadn't done before. [...] JP was a chemical engineer who's working in a field that I could see myself working in. And then my mentor's daughter was also in chemical engineering and she was doing things that I could see myself in. Chemical engineering satisfied the pre-medicine requirements. So I was like, 'Okay, this works. Let me try it.'

In relation to this increase in self efficacy, she said that YES! gave her the opportunity to learn new skills, practice them, and prove to herself that she could do real things:

I think that YES! really gave us that opportunity to explore, and just be happy about ourselves, and become teen scientists early, and show us that, 'Yeah. We can do it.' We literally learn things on the spot. I had never pipetted before. I learned that on the spot. I was able to analyze my research and present it to people. That was something that I'd never done before.

Additionally, YES! provided her the opportunity to build her first relationships with professional scientists. This served to not only make science more accessible, but also helped her gain confidence and realize that she could do anything. Reflecting on these experiences she said:

[YES! was] my first time interacting with actual scientists and [being] on a first name basis with scientists. As a kid, you think that science is not accessible to you. Especially in the situations that I was in. Science was never accessible to me. To meet a doctor, to

meet like a PhD, to meet somebody that was actually...to meet the head of the museum. YES! [...] normalized meeting people, [...] normalized meeting people in the field... I was able to gain so much confidence because then I was like, 'Okay, if I'm on first name basis with the head of the museum, I could do anything. As long as I'm dedicated to this, and I pursue it, and I learn as much as I can, I can do anything.' And so, yeah. In those six weeks I was able to really internalize that. If you dedicate yourself, you could have never known about any of this before. [...] It just really taught me that I could really do anything at a young age and that's important.

There's no way that I can talk about being passionate for science without talking about YES!, without talking about those two summers that I spent there at the museum; learning and building friendships, and just networking with scientists, talking to them on a first name basis...I think that those are really big things. When those barriers, those imaginary barriers that we have growing up, are really just deconstructed and just destroyed--YES! really destroyed those barriers for me. Yeah, you can really, really do anything. And I don't think that my experience is that unique. I think that if you talk to anybody who did YES!, I think that the same things will arise. YES! just really taught you how to be great.

When elaborating on not being the exception, that she was not the only one whose social life, college major, life goals, and sense of self efficacy were impacted by YES!, she spoke about how all the other people in her cohort had gone on to do amazing things. She mentioned one friend who is doing public health and another who “*touched on what she did in her YES! experience and took it to another lab at GW. And now she's studying astrophysics.*”

Because of the impact YES! had on her, she now wants to start or contribute to something like YES!. She said:

YES! also influenced passions that I want to pursue later on....I want to do something like YES!. Like helping kids that come from D.C., Maryland, Virginia, or even any urban area. Having hands on access to science. And I kind of do that now. So my professor in engineering, I always talk about my YES! experience when it comes to inspiring my love for anything, for science and engineering. And so he was like, 'Oh, it'd be interesting if you worked on my project.' That's like they do for [a program aiming to make engineering accessible to all secondary school students]: making engineering accessible to everybody. And so it's the same thing that I did with YES!. So right now, we're doing [a] literature review of engineering education. So I've kind of gone into that field. I just dabbled in it for a little bit, and yeah. I'm more hands on--I want to be able to implement the curriculum. But researching the curriculum has been awesome and kind of understanding what YES! was doing--like the theory behind [it]. It's super cool.

F4 (2016). Confidence to Pursue STEM Through the Lens of Government

F4, a female YES! alum from the 2016 cohort, is a student at a public research university in Virginia double majoring in Environmental Policy and Psychology. Her goal is to become an urban planner with a specialization in sustainability. She was chosen to be interviewed because she indicated that YES! had a great impact on her choice of major, her choice of minor, her career choice, and her life

outside of school and work. Particularly, she felt that YES! helped clarify her interests and encouraged her to be a woman in STEM. Regarding her choice of major she said that:

[YES!] made me passionate about science and opened my eyes to what a career in this field could look like. [...] If I hadn't done research in a lab at my time in YES! I'm not sure I would have felt confident enough to pursue the research I'm currently doing. YES! pushed me out of my comfort zone and showed me how science plays a role in so many different fields of study.

Regarding her choice of minor, she said, "Through YES I realized that as cool as doing research in a lab is, I wanted to look at environmental issues from more of a government lens." Regarding her choice of career, she said:

YES! not only made me more confident as a wom[a]n in the sciences but also taught me so much about all the different scientific fields and possibilities for jobs in those fields. This program helped to push me to think about careers and try to further narrow down what I was interested in and hoped to do one day.

Lastly, with regards to her life beyond school and work she said, "[YES!] helped me [realize] why it is so important for me to push for my place in STEM activities."

When asked to describe herself before and after YES!, she said before YES!:

I was definitely a little bit more hesitant and unsure and not as competent. I also went to a humanities-based high school, so it was very English-focused and a little bit of history too, and not so much STEM, even though I am way more of a STEM person. So I think that that kind of made me a little bit unsure and unclear early on about what I wanted to do.

However, she said after YES!:

I felt much more confident in pursuing higher-level science opportunities. So whether that be I took AP Physics my senior year of high school, [or] all the research, the internships that I've done since then. But I was definitely more confident in my ability to be in a space where real scientific topics are being discussed, or I could have a real input. So I definitely feel more confident. I think a lot of that was because I had more experience. I just felt more confident, experienced and motivated, and I guess more [...] confident in my decisions to pursue higher up STEM-related opportunities.

In addition to increasing her sense of self efficacy, YES! taught her where her strengths lay. She said:

I also felt good about collaborating and working with other people because I kind of think that's one of my strong suits, and I think that YES! helped me kind of figure that out too. Because I really liked working with other people and talking to the other interns and doing work with them.

She also said the YES! taught her new skills such as communication skills and gave her a new understanding of networking:

I really think the collaborative nature and the communication that happened both between interns and then with [the YES! coordinator], definitely just helped me to feel more comfortable and feel a better communicator overall. I don't super keep in touch with a lot of people from YES!, but for a while afterwards I did, and so I think that that helped me to realize that also you can make strong friends and social connections, and be good at networking with people who you are in academic or more professional settings with.

With these new skills, experiences, and increased sense of self efficacy, she was able to go on to do other internships. When asked about how YES! prepared her for a paid internship with the office of sustainability at her college, she said YES! had made her confident enough to apply. She also said that during the interview she was able to talk about her YES! experience which she felt helped her interview a lot.

She then had a similar experience when applying to a non-profit organization involved in education and advocacy related to climate change. She said that when she got her internship with the nonprofit, it was in large part to the legitimacy having done a Smithsonian internship had conferred onto her, and while the skills and experience she had gained through YES! had helped her in her role and made her feel more comfortable in the space, it was YES! helping her get her foot in the door that benefitted her most.

When asked what skills she felt her interviewers found so impressive, though, she said:

[D]oing research at such a young age with the Smithsonian and not just, I don't want to say silly research, but really being behind the scenes with staff and helping them. I think that was seen as really valuable. Honestly, I talked about the science communication stuff too because we had to present, I think a day or two, we had to do TED talks to each other, and then to do presentations to the public about what we were doing, the research, and why was important. And I think, I mean, again, not to harp on science communication, but that is definitely a really important thing in kind of any sort of science or environmental career that you go into. It's just inevitably usually as a part of what you have to do. So that was also something that I was able to speak on. But yeah, I guess the more impressive side was research at such a young age with the Smithsonian, and being able to speak about really specific tangible research that I was doing.

She then went on to explain that she actually ended up using the science communication skills, which she had felt her interviewers had found so impressive, in her non-profit work: “we did do a lot of work at YES! on science communication, which I've found really valuable. I use that a lot at [the non-profit], and I've found that to be a really useful skill.”

In addition to impacting the way she viewed and used science communication skills, YES! impacted F4's perspective on the nature and practitioners of research. When talking about how she viewed

research before and after YES! and how the experience helped challenge her view of who could do research, she said:

I think that sometimes research is sort of seen as something that's inaccessible. It's [...] seen as something that only really high up scientists, who really are super, super knowledgeable and have PhDs can do. And I guess being so young, being a high school student, and still feeling what I was doing was very helpful and still being able to learn a lot and kind of debunk those stereotypes about what research looks like, or who can be involved in it, was really helpful. Because it's sort of a daunting thing if you have no experience with it, like research, it seems sort of a big scary thing that's just a little bit inaccessible. But helping out with research can take so many different forms, and just knowing that if you're passionate about something, you're willing to learn and understand, you can go into a research lab and really help make a difference. I think that's sort of how it helped me to be more confident to seek that out when I was in college.

Moreover, because of a TED talk one of her fellow YES! interns gave and the diversity of her cohort, she left YES! understanding that “[t]here is a place for women, there is a place for people of color, whatever shape or form, there is a place for you in STEM, and it's not just white men in lab coats, anymore.”

Lastly, she noted that her current interests came from opportunities she pursued largely because of YES!. Her current interest in urban planning came from research she had done in high school as a result of YES! making her comfortable and interested in engaging in STEM research. Additionally, her current interest in the work done on Capitol Hill came from her non-profit work which she got to do because of YES!:

“I really don't think I would've applied to [the non-profit] if I hadn't done the YES! thing or I don't think I would've gotten as much out of that. [The non-profit] is the reason that I went on the Hill and got to the national hearing.”

F3 (2017). Inspired by an Effective Mentor

F3, a female YES! alum from the 2017 cohort, heard about YES! through a friend who spoke highly of the program. She participated in YES! 1.0 in 2017 and in 2.0 the summer after in order to gain lab experience. She currently attends a public research university in Virginia, majoring in Environmental Science in hopes to pursue a career as an environmentalist. She was chosen to be interviewed because she indicated that YES! had a high impact on her career choice and on her life outside of school and work.

Through her YES! experience, F1 was able to experience science in a variety of work environments. During YES! 1.0 she worked directly with live animals at the zoo. During her 2.0 project, she worked behind the scenes in a lab imaging parasitic wasps, where she felt she was contributing to work that was significant in a greater context. Through these two experiences, she gained a better understanding of what a career in environmental science could look like, either working directly

with animals or in the background in a research lab. Experiencing working in science in a variety of settings combined with her changed perception of what doing science looks like contributed to her majoring in environmental science. As an environmental science major, the science communication skills gained through YES! have also enabled her to better communicate with her professors and peers at college.

YES! also challenged her understanding of lab work. Prior to YES! she considered scientists and labs to be cold and unapproachable. But now she sees it differently:

When you get to work in [a lab] and contribute to a research project ... it's a lot more comfortable and it seems a lot less intimidating and cold. Since I went to a research lab every single day, it became like my second home.

Moreover, because her mentor welcomed her into the lab before she started work, she got to start her internship already a little less intimidated. She said this new understanding “*expanded my knowledge about what I could do in an environmental science field*” and that without this new understanding she likely would not have pursued environmental sciences.

In addition to wanting lab experience, F3 applied to do YES! 2.0 because of her mentor. She enjoyed him because he was able to get work done and still be fun. He talked to his mentees about things outside of their project and developed a genuine relationship with them. Coincidentally, her mentor was also from the same country as her parents which deepened their connection.

Moreover, he looked out for his mentees by passing along opportunities outside of the Smithsonian and talking to his mentees about the importance of college. She said, “*I always knew I'd end up going to college, but him solidifying the reasons why college was so important, it just made me more excited.*” F3's mentor, pushed her to reach her potential. Not only did he encourage her to go to college, but he also encouraged her to create the best work she could.

When describing the person she was before YES! and the person she was after YES!, F3 said she underwent great personal development from being a part of the YES! internship. From taking the metro to being by herself to talking to adults not in the presence of her parents, she was able to gain independence and come into her own. Because the YES! internship was her first job outside of a restaurant, she learned how to be professional in an academic environment. Seeing herself succeed at a place like the Smithsonian gave her a greater confidence that she was able to then carry with her to college:

I know what I want to do now and I know how to pursue it. I know how to be professional and it just created, I guess, a more confident version of myself.

F9 (2018). Challenging Scientist Identity Stereotypes

F9, a female 2018 YES! alum, is currently attending a private university in Pennsylvania where she is double majoring in Biology and Integrated Science, Business, and Technology. She hopes to go on to medical school in order to pursue a career as a physician.

She was selected to be interviewed because she indicated in her survey responses that YES! greatly impacted her choice of major, minor, career, and activities outside of school and work. Regarding her choice of major she said that:

Being able to work in such close proximity to those in STEM fields and having such a positive workplace resulted in my determination to pursue a degree in a STEM field. In addition, I have broadened my horizons as a result of the YES! program and I am now hoping to seek both a PhD and MD in my future through a VCU program in order to seek a career in medicine.

With regards to her choice of minor she said, "I saw through my internship that [science, business, and technology] are constantly working together." With regards to her career choice she said that:

Being able to see how much science can assist others and improve their lives through the YES program played a large role in my career choice. In addition, I was able to understand that researching and education is something that I am interested in. I am hoping to be able to educate others on the importance of research in my future and to inspire the next generation of STEM enthusiasts.

Finally, with regards to her life beyond school and work she said:

Through the field trips that involved conservation of the planet and through my close involvement with animals at the zoo, I have taken on roles in clubs where I educate others about the importance of conservation. In addition, by the example of the YES program leaders, I have realized the importance of giving back to the community and through college I am planning on being a part of AIDs outreach in the Philadelphia community and aiding the global community through aid trips to Kenya and Honduras through programs funded by my school.

She chose to do YES! because she has always loved museums and felt pursuing science would help with social mobility. She ended up finding the opportunity online because she was actively searching for opportunities like YES!.

Museums have always been important to F3 because:

They really taught me that you don't have to be a certain type of person to be able to be a scientist. You don't have to be the specific pigeonhole, kind of stereotypical idea of what a scientist is. Beyond that, just being able to get the hands-on experiences that the museum provides was fantastic, and being able to be surrounded by so much natural history really made it interesting

YES! helped further this understanding through the diversity of its mentors, interns, and staff. She said having a mentor who was a part of the LGBTQ community, being in a cohort that was diverse with regards to gender and race, and interacting with NMNH scientists who had tattoos and dyed hair were all really impactful in developing this understanding of who can take part in science.

In addition to furthering her understanding of who could be a scientist, she said, through YES!,

"I personally learned a lot about myself. I learned a lot about science. I learned a lot by research. I learned that I could really be able to be a part of this ... I honestly thought that the Natural History Museum was so far out of my reach. Even though I was able to go there, I never thought that I would be able to work there in any capacity, even as an intern."

However, YES! gave her the confidence she needed to communicate about science. Regarding science communication, she said:

I think the YES! program definitely gave me some confidence in what I'm saying about science. I think it definitely gave me a level of self-assurance that I wouldn't have had otherwise. She used to talk to her friends about fun facts, but now she feels confident about talking to people about science, especially topics she learned through YES! such as conservation.

YES! also solidified her desire to pursue a STEM related career, and made her confident enough to do so. She said:

I think before YES! I thought about maybe going into a career in the science field. I was definitely not sure of that. There [were] many other options I was considering. After the YES! program, I was definitely going into a STEM field. There was no doubt about that. I was completely ready for it. Before this program, I felt like I couldn't do it. I didn't think that I could ever be a STEM major. I didn't think that I could ever hold a candle to anyone who was in the STEM field. But I think being able to have experiences I did, being able to see who was in that field and not having them so far removed from me was definitely a big deal.

Overall, she feels she came out of YES! a clearer and more confident person:

"I think just as a person it's helped me become better. I think I speak slightly clearer. I think I'm a little more confident, and I think I hold my chin a little higher. So I definitely think it's been a positive experience for me as a person."

Regarding the specifics of her career, YES! helped her realize her interest in research. She said:

Sometimes in school you get projects that you're not necessarily interested in, so of course you're not going to want to do that kind of research. Being able to have a specific field that I was interested in was helpful for me. That's actually why I'm planning on pursuing a PhD/MD program. [I]f I had just [done] boring research, of course I wouldn't want to make that my job, but being able to see that research can be interesting, made a difference for me.

Thanks to learning that she did not have an aversion to research, she was later able to discover that she was interested in clinical research in particular. She said:

Clinical research wasn't necessarily a product of YES!, but without the YES! program, I wouldn't have even thought about looking into research programs or looking into anything other than simply, just purely doctorate. I wouldn't look into having a PhD. I

wouldn't look into being a researcher. I wouldn't look into any of that, and I honestly don't think I would be able to make as much of a difference.

Programmatic elements of the YES! program, such as a financial literacy session and the science communication training also impacted F9. During the fall, program staff lead sessions and invite other experts to lead sessions with the YES! interns focusing on college and career readiness. She said:

I remember we had one talk about [financial literacy]. It was a very short talk, actually. I wish it was longer. It was a man who came, and I don't remember what his name was. He handed out some pamphlets. I still have mine actually. He talked a lot about credit, which is something I never have talked about with anyone ever actually. So really anything about credit was fantastic. He talked to us a lot about how he personally didn't have money and he's found a way to make sure that he doesn't ever get into that position again. I've never actually had a financial literacy talk in any other capacity with anyone. So having it through the YES! program was fantastic. I didn't know anything about credit. I didn't know anything about credit scores. I didn't even know how to get a credit card or anything like that. Being able to hear someone talk about how important your credit is was definitely different for me and was very helpful.

YES! also helped F9 develop her interest in education. She said that while she had always been interested in STEM education, YES! gave her the tools to actually pursue it:

"I think I've always had it. I think the YES! program has helped influence it more. It's helped...[definitely] focus it more. I wouldn't have any idea how to educate without all the resources I got from the YES! program. I would be very lost."

She said that Reach 100 in particular helped cultivate her interest in education. She enjoyed that activity so much that she reached out to far more than 100 people; she even went to her mom's elementary school. She said:

"Being able to be an educator myself was really helpful, informative in letting me know that I could in fact actually make a difference through that."

Further, she said:

Being able to see how people are educated through science is interesting. I liked being able to be at the museum every day and seeing people learn more, and seeing especially little kids learn more. I personally lived in the DC metro area for most of my life, and I would never have even thought of science as a career path without the museums. So being able to be a part of the educators who basically set a light in children's hearts about science, it was really interesting. And that made me really interested in going into what I want to do, and it's why I am a biochemistry major currently. So, it's just really interesting. I love the purpose of museums. I love the education that they do, and it's just amazing how much it can change people.

In addition, she said that YES! increased her access to science, and she wanted to get involved in STEM education in order to improve access for others. She said:

I personally believe that everyone should have every door open to them. I don't think that, especially as a child, you should have any doors closed to you. I personally have had a lot of doors closed to me. Being able to be a part of the YES! program I think actually opened quite a few. Having the connections, being able to talk to scientists, being able to talk to people like Heather and Ben were a very good influence on me. Being able to be the same kind of person for someone else means a lot to me.

Appendix C. Program Strategies: Contribution to Learning

	over code	sub-code acad/ career/ other	Child code	Community Day	Intern is in	Staff	Talking sessions	TED	college prep	science communication training	Tour field trips	fellow interns	Mentor	Contributing Codes
direction	acad-career path	acad	Academic Direction & College Experience								2	2	1	TFT: Academic Development, M: Exposure to Grad School Level Science Early On; S: Furthered Academic Career
direction	acad-career path	acad	Awareness				4		8				3	TS: Broadened Perspective on My Education; TS: Broadened Knowledge; TS: Eye Opening Understanding of College; TS: Learned about diff paths to college; CP: Awareness of Educational Options1; CP: Felt More Informed Re College4; CP: Interest in Understanding College At Young Age 1; CP: Learned About Opportunities for Next Step 1; CP: Talking to College Students Gave Greater Perspective 1; M: Awareness of Different Routes in College; M: Learned about their career path; M: Research as a Career
direction	acad-career path	acad	College Prep				1		11					"TS: Talking to College Students Beneficial CP: Learned About the Application Process 5;CP: Choosing a College 1; CP: Prepared for Next Step (College)2; CP: Prepared to Get Started on College Path 1; CP: Enabled to Apply for Scholarships 1; CP: Gave Insight That Program Led to College 1; TS:
direction	acad-career path	career	Career direction			1	2				2	2	1	TS: Career Clarity 1; TS: Understanding of Future Career 1; TFT: Career Clarity 2; FI: Solidified Desire to Pursue STEM Major 1; FI: Solidified Desire to Be in an Academic STEM Community 1; M: career clarity: Interactions Helped Decided Career Field 1; S: Interactions Helped Decided Career Field 1;
direction	acad-career path	career	Professional development				2		2	2	2		1	CP: Aided Creation of First Resume 2; TS: Professional Development 1; SCT: Important skill in chosen career path 2; TFT: Professional Development 2; M: Prepared for Job; TS: Valued Communication Skills in Future Internships 1

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direction	acad-career path	career	Career awareness				1			3	5	TS: Broadened Perspective on Specific Science Fields 1; TFT: Insight into What Career in Science Looks Like 1; TFT: Understanding of Future Career 1; TFT: Understanding of Steps to Future Career 1; M: Career Exposure 5;	
direction	acad-career path	both	Academic and Career Preparation			1	1		1		2	S: Letters of Rec 1; SCT: Ability to Thrive in Science Environments 1; M: Working with a Mentor 1; M: Reference 1; TS: Opportunity to See Research in Many Fields1	
direction	interest/passion		Interest/passion						1	1	3	1	TFT: Helped Develop Passion for Communication 1; FI: Inspirational 2; FI: Interacting with FI lead to excitement about what doing and learned others' experiences 1; SCT: Still Passionate About SC 1; M: Sparked Interest in Natural Sciences 1
exposure	exposure	diversity	diversity							2	3		TFT: Exposure to the Other Side 2; FI: Opportunity to Interact with Different People 2; FI: Met People from Different Areas 1
exposure	exposure	museum	museum			2				2			S: Interactions with Scientists and Museum Education Were Insightful 1; S: Behind the Scenes is Equally Important 1; TFT: New View of the Museum 1; TFT: Nice seeing behind the scenes specimen 1
exposure	exposure	new information	new information					2					CP: Access to Info Otherwise Wouldn't Have 2
exposure	exposure	political world	political world									1	M: Window into the Political World
exposure	exposure	science	science							5			TFT: Exposure to Different Realms of Science
exposure	exposure	scientists	scientists			1							TS: Talking to Scientists Beneficial
skill/learning	communication	general	skill						1				SCT: Learned Concise Communication
skill/learning	communication	general	passoin	1									CD: Helped Develop Passion for Communication
skill/learning	communication	general	public speaking				4		1				TED: Modulating for Audiences 2; SCT: Public Speaking Skills 1; TED: Improved Public Speaking Skills 1; TED: Use Public Speaking Skills at Work 1
skill/learning	communication	general	about self						3				SCT: Explain Self (SCT: Explain Interests 1; SCT: Communicating Thoughts to Influence Others (1); SCT: Learning to Convey Experience to Others 1
skill/learning	communication	general	with strangers				1						TED: Practice Speaking to Stranger; TED: Comfortable Speaking with Strangers

skill/learning	communication	general	for future internships			1			1			1		S: Valued Communication Skills in Future Internships; CP: Valued Communication Skills in Future Internships; FI: Valued Communication Skills in Future Internships
skill/learning	communication	general	general			1		1				1	1	S: communicating with others;
skill/learning	effect on program	effect on program	effect on program			2	1					1		S: Interactions Helped Progress Through Program 2; TS: Interactions Helped Progress Through Program; FI: Motivated Me to Work Hard
skill/learning	Learning content	general learning and understanding	general				3					2		TFT: Educational; TS: Improved Understanding; 2 TS: Learned 1
skill/learning	Learning content	general learning and understanding	learning through peers' experiences									3		FI: More Learning Through Their Mentors/Experience 3
skill/learning	Learning content	learning mode	learning mode				3	3	1	2	2		2	TS: Suited to Learning Style 1; TS: Interactions with Scientists and Museum Education Were Insightful 1; TS: Opportunity to Ask Questions 1; TED: challenging to be creative 2; TED: Suited to Learning Style 1;TFT: Seeing the Content Aided Understanding 1; TFT: suited to learning style 1; M: One on One Experience 1; M: Suited to Learning Style 1; SCT: Suited to Learning Style 1; SCT: Teaching others cemented understanding 1; CP: Suited to Learning Style
skill/learning	Learning content	science	science										3	M: Chose YES! to Learn Science 1; M: Increased Science Knowledge Most 1; M: Learned the Most Science from Mentor 1
skill/learning	personal development	perspective	perspective									1		FI: Being in 2.0 and Seeing 1.0 Students
skill/learning	personal development	professional	professional				1	1	1				3	TS: Can Be Taken Seriously by Professional Scientists; M: Developed Strong Work Ethic 1; TED: Managing Deadlines; CP: Prepared for Adulthood; M: Prepared for Real World 1; M: Responsibility
skill/learning	personal development	risk takng	risk takng			1			1				2	TED: Got out of comfort zone; M: Got out of comfort zone; M: Learned Payoff of Taking Risks; III: Stepped Out of Comfort Zone
skill/learning	personal development	role model	role model										1	M: Role Model

skill/learning	personal development	science	science									1	M: Can Be Taken Seriously by Professional Scientists	
skill/learning	personal development	sense of direction	sense of direction									1	M: Took Mentors Advice Seriously	
skill/learning	personal development	sense of self	sense of self	2	2		1	3		3		1	2	TED: Built Confidence 2; TED: More Comfortable Speaking 1; SCT: Confident Talking to Strangers 1; SCT: Increased Confidence 2; M: Contributed to a project as a high school student 1; M: Improved Self Concept 1; TS: Improved Self Concept1; III: Increased Confidence 2; FI: Increased Confidence 1;
skill/learning	personal development	social	social								1	2		FI: Increased Social Skills 2; TFT: Team Bonding Opportunity1
skill/learning	reflection	reflection	reflection					1						TED: Opportunity to reflect on all they learned
skill/learning	research	research	research	3									3	CD: Enjoyed presenting research 1; CD: Opportunity to Speak Confidently About Research Done to Scientists 1; CD: enjoying seeing others interested in my research 1; M: Research Development 1; M: How to Research Effectively 1; M: Understanding Research 1
skill/learning	science communication	make science understandable	make science understandable							3				; SCT: Ability to Present on Science 1; SCT: Explain JobSCT: Ability to Explain Science in the Real World
skill/learning	science communication	public speaking	public speaking					5						TED: Presentation Skills (TED: Comfortable Presenting in Front of Others 1; TED: Distilling Information 2; TED: Making a Good Presentation 1; TED: Prepared for Future in Presenting Research 1)
skill/learning	science communication	share self	share self	3	1									CD: Opportunity to Share with Fam/Friends/Other 3 Youth + Museum What Learned/Did;
skill/learning	science communication	skills	skills	4	5	1		3		4			2	CD: Use Science Communication Skills 4; III: Communicated What Learned Over Summer 1; III: Disseminating Information to Strangers 2; III: Distilling Information 1; III: Opportunity to Explain Influence of Science in the Everyday 1; S: Communicating Science 1; TED: Hone Science Communication Skills 2; TED: Opportunity to Share Work 1; SCT: Formulate Scientific Thoughts 1; SCT: Engaging with Scientists About Acquired Knowledge 1; SCT: Engaging with Visitors About Acquired Knowledge 2; M: How to Present 1; M: Science Communication 1

skill/learning	skill building	skill building	skill building		1		1	17	1	3	1	III: Improved Useful Skills; TED: Opportunity to Cement All Skills; SCT: Actually Put Skills to Test 1; SCT: Developed Teaching Skills 1; SCT: Developed Useful Skill 1; SCT: Important Skills Development Component 4; SCT: Important scientific skill 1; SCT: Least Developed Skill at Start 1; SCT: Opportunity to Interact with Visitors Developed Communication Skills 2; SCT: Reinforced Learning 2; SCT: Skill never formally taught 1; SCT: Teaching Others Cemented Understanding 1; SCT: Transferable Skill 2; TFT: Valued Communication Skills in Future Internships; FI: Developed Crucial Skills; FI: Teamwork; FI: Capable of Working With Those Who Are Different; M: How to Use Equipment
skill/learning	understanding science	understanding science	understanding science						10	1	8	TFT: Insight into Science Relying on Communication 1; TFT: Insight into Science Relying on Communication 2; TFT: Increased Interest in Science 1; TFT: Opportunity to Interact with Scientists 1; TFT: Opportunity to Interact with Scientists Up Close 1; TFT: Put Internship in Perspective with Science Community 1; TFT: Importance of Having Collections 1; TFT: Importance of Research 1; TFT: Understanding of diverse current SI research projects 1; FI: Increased Interest in Science; M: Exposure to Day to Day as a Scientist 2; M: Exposure to Different Realms of Science 3; M: Exposure to Mentor's Specialty (change to field)3 ;
skill/learning	value	value	value				5	2		1	3	SCT: Most Beneficial 1; CP: Useful 2; CP: Impactful 1; CP: Helpful Bc Low Income 1; CP: Helpful Bc First Generation 1; FI looked up to ; M: Impactful 1; M: Why Selected Internship 1; M: Felt Work Was Impactful 1;
social	network	network	network		1					4		S: Network: Built Connections 1; FI: Met Interns Still in Touch With 3; FI: Support Network 1
social	peer connection	peer connection	peer connection						1	10		FI: Increased Social Circle 15; TFT: Opportunity to Communicate with Fellow Interns 1; FI: Connect with Teens with Similar Career Interests 1; FI: Connect with Teens with Similar Science Interests 1; FI: Made Memorable Connections 3; FI: Met Close Friend(s) 4;
social	relationships	relationships	relationships								4	M: Still in Touch; M: Continued Involvement in Mentorship; M: Continued to Be a Mentee; M: True mentor

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family	family	family	family						1							CP: Helped Parents Understand Application Process
value	effect on others	effect on others	effect on others		1			1		1						M: Now a Mentor; TED: Understood personal experience can impact others; III: Opportunity to Speak Work With the Community;
value	inspiring others	inspiring others	inspiring others	1												CD: Enjoyed Inspiring Others to Become Citizen Scientists
why	fun, memorable, enjoyable	fun	fun		1	1	1	1		1	2	2				fun; S: Fun connecting with people who enjoy teaching others a subject theyre passionate about 1; TS: Most Exciting Days; III most fun
why	fun, memorable, enjoyable	memorable	memorable		1	1		1	1		3	1	3			III: Most Memorable
why	traits	traits	traits			5					1	2	4			S: Kind; S: Knowledgeable; S: Great Mentors; S: Nice; S: Welcoming; TFT: Interactive; FI: Nice; M: Encouraging; M: Inspiring; M: Kind; M: Explained with precision - set up for success; ; FI: FI Were Encouraging
	total number of categories			6	8	10	13	14	10	14	16	18	24			

