



Smithsonian Institution

NATIONAL
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NATURAL
HISTORY



CENTER FOR RESEARCH
AND EVALUATION

Lifelong Learning Group

**National Museum of Natural History:
Science Career Access and Learning Experiences
Evaluation Report**

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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. In its first year, SCALE programming expanded established Q?rius Youth Science Academy programming (for Q?Crew volunteers and YES! interns) to include a community science event, robust after school program offerings, and an outreach initiative intended to reach an additional 3,000 students in the Washington, DC area.

SCALE programming sought to expand access to unique, science rich, out-of-school time activities and paid internship opportunities to young people from under-resourced communities and those traditionally underrepresented in science. Thus, programming was designed to involve a pipeline of tiered opportunities (described below) to funnel participants from broad access to more focused leadership opportunities. In this pipeline, the Teen Night Out community event would serve to attract new learners. Participation in the workshops would provide an introduction to natural history science, technology and career, Participation in the leadership programs would (1) promote and affect interest in and motivation for studying science and science careers; (2) enhance comfort with communicating about science, (3) instill specific science-related content or skill; (4) enhance 21st century skills (including, communication; critical thinking; creativity; leadership; and social and emotional literacy); and (5) create both professional and peer support networks. The SCALE administrators were also interested in learning more about working with community collaborators to reach teens more effectively in under-resourced communities and those traditionally underrepresented in science.

The Lifelong Learning Group at COSI's Center of Research and Evaluation (Franklin County Historical Society dba COSI) conducted extensive 2018 evaluations of each program step in the SCALE pipeline. The evaluation was designed to determine how each step in the pipeline functioned to produce its intended outcomes. To understand and document both program quality and outcomes achieved, the Lifelong Learning Group used a mixed method approach involving online surveys consisting of psychometric, inventory, and open-ended responses; teen feedback discussion groups; and structured interviews. Thus, this report represents responses from 64 Teen Night Out community event participants, 88 workshop participants, 24 YES! interns, 15 Q?Crew volunteers; and 5 Q?Crew Captains and one community partner.

The Lifelong Learning Group (Franklin County Historical Society dba COSI) 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. Through its work with a wide range of cultural and scientific institutions, programs, and initiatives, the Lifelong Learning Group seeks to serve the field by contributing insights, building capacity, and promoting rigorous, meaningful research that supports the creation of innovative, learner-centered experiences for

individuals across the lifespan. The Lifelong Learning Group of the COSI Center for Research and Evaluation is a business unit of the Franklin County Historical Society dba COSI, a 501(c)(3) non-profit organization. COSI provides administrative, fiscal, and institutional support, as well as rich opportunities for collaboration and innovation between the Lifelong Learning Group researchers and COSI's internal evaluation and research initiatives. Among the researchers, with decades of experience researching and evaluating processes and outcomes in informal learning settings, the Lifelong Learning Group researchers each contribute a unique area of research and evaluation expertise while maintaining a commitment to collaboration and shared learning across projects and disciplines.

The Programs

The Teen Night Out @Natural History event, (the event with broadest access) was a singular broad awareness event that offers a set of fun, immersive experiences designed to introduce teens to science and museum careers, including the scientific research that takes place behind-the-scenes at NMNH. The event also sought to interest participants in the NMNH youth community opportunities.

Natural History Investigations Workshop series consisted of After School Workshop certificate series (science exploration), involved teens enrolling in a series of four classes that would together provide an introduction to natural history science, technology and careers. A second series, postponed and abbreviated due to the government shut-down in December 2018, was held in January and abbreviated to a two class workshop.

The **Q?Crew** leadership program provided volunteer opportunities for teens to engage in science by facilitating experiences for museum visitors to the Coralyn W. Whitney Science Education Center's Q?rius exhibition space, where they can interact with the museum's extensive educational collections, and hands-on manipulatives.

The **Youth Engagement through Science program (YES!)** leadership provided an in-depth science internship and professionalization opportunity designed to meet teens' needs for a more professional and immersive science experience by also providing college preparation classes, mentoring, and other opportunities to both build and use authentic scientific and science communication skills.

Community Collaboration. In order to better serve local youth who typically have limited access to Smithsonian programming, NMNH youth program staff is seeking to strengthen community partnerships. To help inform that effort, CRE LLG conducted an interview with the leader of one

after school program identified by NMNH as an ongoing community partner serving this population¹.

Evaluation Questions

1. How much has each youth program affected participants 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.
2. How and in what ways did the Teen Science Night and Natural History Investigations Workshop series function to interest teens in further Q?rius youth programming, comfort with museum visits and involvement, and/or further interest in science?
3. In what ways can future outreach efforts with program partners be designed to effectively recruit teens from the targeted demographic groups?

Methods


Question 1	Pre and Post program online questionnaires Feedback Discussion Groups
Question 2	Teen Night Out post-program online questionnaires Workshop pre and post online questionnaires
Question 3	Community Collaborator Structured Interview


Results- Q1. How the Programs Affected Participants


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

¹ We note that the project called for interviewing four community collaborators, but of the two identified, only one was available for contact.


Q1a. How the YES! Affected YES! Interns


 **Program Activities.** All but one of the YES! program activities contributed equally to “all the ways you have changed and what you have learned.” To the credit of this mentorship program, the one exception, “relationship with your science mentor”, contributed most.


 **Motivational Quality.** Satisfaction of interns’ need for sense of autonomy has been high and climbing over the past three years. This trend portends well for the program and for durability of positive outcomes. Need frustration, while generally low and reduced from 2016 to 2017, rose again in 2018. Sense of competence followed a similar pattern. Possible reasons and recommendations offered by intern feedback involved mentor selection (scientists who “know how to talk with teens”) and intern selection (emphasize openness to learning over accomplishment).


 **Science Interest.** YES! Interns perceived themselves as experiencing a significant increase in their interest in science and that their YES! experience worked with other life factors to create that difference. The YES! experience contributed to that change most highly in the areas of family encouragement and family academic interest. This high influence on family support for science interest may be due to the combination of what families see as gainful employment along with the Smithsonian “brand” as an institution of excellence.


Recommendation: Take steps to further strengthen this important already successful impact on family support for interns’ continued science interest and career pursuits.


 **Science Identity.** Overall, most interns perceived themselves as either maintaining or strengthening their science identity. They particularly demonstrated change in the area of being aware of how science impacts their lives.


 **Academic and Career Intentions.** Overall, YES! had greater impact on academic intentions than on career intentions. Across both, the internship functioned to reinforce rather than change these intentions.

 **Science communication.** Interns greatly improved their science communication skills and largely attributed that change to YES!


 **Science Content.** YES! interns’ content learning ranged beyond learning about specific topics which comprised only a quarter of the topics reported. Equal amount of learning occurred in the areas science process and inquiry and conducting research. Content learned also included science communication, communication in general, and learning about careers. A large majority of interns also commented on and explained the relevance of this new understanding to their personal lives.

 **Leadership and Identity.** The YES! experience contributed to interns Leadership skills and personal identity. They particularly attributed to YES! greater ability to think about how their actions affect others ; greater ability to work as part of a team or group; being willing to take on a leadership role, and being able to accept responsibility.

 **Critical Thinking.** Interns perceived themselves as having improved significantly across all aspects of critical thinking. Most attributed to their YES! experience was “predicting how well I will do a specific task,” and “Applying what I learn to solving problems.”

 **Creative Thinking.** Interns’ appreciation for creative thinking across the steps of the scientific process was relatively high and remained unchanged over the course of the internship. There were no differences between year groups.

Q1b. How the Q?Crew Youth Volunteer Program affected Q?Crew Volunteers

 **Program activities.** Of all the Q?Crew activities, interacting with museum staff contributed most to volunteers’ positive outcomes. On the other hand, discussion group participants believed captains were equally as helpful as staff. Of note was that neither volunteer enrichment sessions nor peer relationships were seen as contributing to outcomes achieved. Pulse checks were viewed as opportunity for staff learning rather than volunteer enhancement.

Recommendation. Consider providing specific and useful feedback to make pulse checks a learning opportunity for volunteers.

Recommendation. Consider encouraging and perhaps formalizing more peer to peer facilitation, learning, and sharing of skills.

 **Motivational Quality.**


It brings a big feeling of WOW! I’m really helping out. It increases my self-confidence a lot. My ideas were an important contribution. I belonged. I’m part of something bigger – the Smithsonian.

In line with a program that successfully motivates youth development, satisfaction of volunteers’ basic psychological needs for sense of competence, relatedness, and autonomy were high and frustration of those needs were low. Over the past three years volunteers’ continually improved basic psychological need satisfaction reflect continually more internalized motivation and consequently, that program outcomes will be enduring and lead to participant well-being .

Discussion group explanation for continuing need satisfaction improvements involved better, more mentor-like, relationships with Captains; improved relationships with YES! interns; and [the Youth Volunteer Coordinator]. Experiences of sense of competence emerged from working with adult volunteers and with challenging opportunities like being alone with a demonstration cart. Peer relationships functioned to enhance the experience but could be distracting.

Recommendation. Continue to support peer mentorship opportunities with Captains

Recommendation. Consider finding and formalizing complementary roles for peers working together to enhance visitor and volunteer experience.

 **Interest in Science.** The Q?Crew experience functioned in conjunction with other extra-program influences (e.g. school, family, etc.) to contribute to volunteers’ perceived significant

increase in science interest. Changes occurred primarily in the areas of in “getting a job related to science” and feeling that “I will have a successful professional career and make significant contributions to science.”



Science Identity. Most volunteers entered the experience highly science-identified. There was very little evidence that Q?Crew affected that identity. Across the group, self-reported science identity changed somewhat in both directions.



Academic and Career Intention. Q?Crew appeared to have moderate effect on academic and career choice. Most responding volunteers’ career choices remained the same after their Q?Crew experience as before. Almost half reported high effect on their academic choices and of that group, most intended to study a natural science with the remaining intending to study a social science.



Science Communication. Volunteers perceived themselves as significantly improving their science communication skills and largely attributed that change to Q?Crew. For these volunteers, science communication was seen as a vehicle for two-way discovery, encouraging others, and creative thinking. Volunteers generally rated themselves as between “weak” and “just ok” before their volunteer experience to between almost “strong” and “very strong” afterward.

I was trying to figure out, what should I do? [Her companion explained] “my friend can’t see.”So instead, we went ... the most touchable stuff. Like fossils ... And I took her to the cultural anthropology section [where there’s a lot to touch] and showed her an abacus. She had fun playing with that. She taught me about using an abacus. Because that’s how she’s learned arithmetic. Then she could also touch toys and dolls. [That experience was] so unique. I will never forget that. (from a participant in the Q?Crew feedback discussion group.)






Science Content. Q?Crew volunteers’ content learning most frequently involved specific facts or topic areas. Content learning also included but less frequently, science communication, career opportunity, research processes, environment, and museology. Thought less-frequent, this type of learning could be highly meaningful. For example:







I discovered the field of physical anthropology over the summer, and I learned much about the kinds of research occurring with the museum specimens. Through the exposure that Q?Crew provides, I was able to get in contact with Kari Bruwelheide and gain insight on how the museum’s bone collections can help answer historical questions and contribute to our understanding of the past. Also, it’s very mind blowing. My mind has been blown.




Learning about Smithsonian research conducted at NMNH. Feedback discussion revealed that learning about Smithsonian research came primarily from talking directly with researchers who are “interesting to teens.” The SERC field trip experience that had been designed to introduce volunteers to the subject, functioned as a bonding experience and introduction to the research topic (environmental science) rather than the research process. By the time of this report, staff had already initiated changes to this experience.


-  **Leadership skills.** Q?Crew volunteers significantly changed in their leadership abilities, though overall this change was only “a little” attributed to Q?Crew. This change could then be due to external factors facing the volunteers.
-  **Critical Thinking.** Volunteers report significant change across the critical thinking skills. This change was “a lot” in part to their time with Q?Crew.
-  **Creative Thinking.** There were no significant changes found in how volunteer perceived the role of creative thinking in science.


Q1c. How the Q?Crew Captains Internship affected Q?Crew Captains

-  **Program activities.** Q?Crew Captains drew value almost equally from all aspects of the Q?Crew experience except pulse checks and interactions with adult staff.
-  **Motivational Quality.** In line with programs that successfully motivate youth development, satisfaction of captains’ basic psychological needs for sense of competence, relatedness, and autonomy were high and frustration of those needs were low.
-  **Interest in Science.** Captains did not have significantly more interested in studying, pursuing, and enjoying science. The least amount of attribution to Q?Crew participation was family related. Other items related to jobs or careers were contributed somewhat to their participation. This could indicate that captains, having already participated in Q?Crew before, found influences for their science careers and academics elsewhere.
-  **Academic and Career Intentions.** Most captains had academic and career aspirations that were natural science related. All reported low effects of their Q?Crew captain experience on their aspirations.
-  **Science Communication.** Captains perceived themselves as having improved their communication skills and attributed that change between “somewhat” and “a lot” to their Q?Crew Captain experience.
-  **Science Content.** Most captains listed learning related to specific fields, primarily within paleontology and forensic ornithology. Second most frequently, they listed communication skills (including mentoring and leadership). Research processes and understanding scientific methods; career exploration; and museology (collections management) were also areas of specific content learning. Learning occurred across these areas as shown in this comment:

The learning that I did with bird lab and the forensic ornithology team gave me the most content. Learning about the processes that they use to ID birds, the various levels of microscopy, microstructures, and pigmentation and the use of this element in the feather was really insightful. This was also a window into how research in ornithology is done and [how] the steps in the ID process [are] done.


 **Leadership skills.** Captains perceived a high program effect on their feelings of confidence to try new things, abilities to work as part of a team, and to share their thoughts or ideas with others.


 **Critical Thinking.** No significant changes were reported and the captains reported that Q?Crew did not have a large effect on their critical thinking skills. This could indicate that captains, since they had already participated in the program, Q?Crew didn't have as much of an effect on critical thinking skills.


 **Creative Thinking.** Over the course of the summer Q?Crew captains discovered room for more creativity in the science process areas of “analyzing results of a scientific investigation; creating a graph for presentation to others; and asking questions that can be answered by collecting data.


Results – Q2. How the Teen Night Out Community Event and the Natural History Investigation Workshop Series functioned in the SCALE Pipeline.


Q2a. How the Teen Night Out community event functioned in the SCALE Pipeline

 **Science Interest.** All Teen Science Night participants rated themselves as having at least some interest in science over the past 12 months. Most had moderately high interest.


 **Perceptions of the Teen Science Night.** The event functioned to interest participants in visiting NMNH again and see more of the museum.

 Most all Participants also agreed that the event made them want to participate in more NMNH activities. Further, the event functioned to provide a social context for young people interested in science.


 To the event's credit, most all of the participants arriving with low-moderate interest and half the group with high-moderate interest felt that the event showed them science could be more interesting than they had thought.


 **Outreach and New Participation.** The event reached new participants and interested them in further programming. Two thirds of participants said they had never previously attended any NMNH programming. Of this group, almost half wanted to be contacted for workshops, volunteering, or an internship; 53% wanted to be contacted about another Teen evening event; and only two asked not to be contacted.


Q2b. How the Natural History Investigation Series Workshops Affected Participants and Functioned in the SCALE pipeline.


 Participants arrived to both the 2018 and 2019 workshops very interested or extremely interested in participating in YES! or Q?Crew. Approximately two thirds of participants experienced a change in that interest—although that change occurred in both directions--equally as many participants became more interested as those who became less interested. This finding suggests that the workshops functioned in the pipeline both to generate interest and also to function to help students self-select, perhaps, for instance, helping them to understand the realities of the commitment to these programs.

Recommendation: Recognize and build into programming these programs' dual roles in the NMNH youth education pipeline.


 **Pre workshop intentions and programming.** Most participants chose to enroll in workshops because they wanted to learn more or because they were excited or enthusiastic about the workshop topics. Just less than a quarter of participants had attended teen night out and of that group, half found the event important to their decision to sign up for a workshop.

 **Effect on interest in applying to YES! or Q?Crew.** Overall, the workshops had only minor, if any, effect on participants' increased interest in applying to YES! or Q?Crew.

 **Effect on attitudes toward science and museums.** In general the workshop had at least some effect on most all participants' attitudes toward science and museums (87%) with least effect on visiting other Smithsonian museums (65%). Explanations of effect on studying science in school were primarily affective (involving feeling more “knowledgeable,” “prepared,” “inspired” and “confident”). Similarly, explanations of effect on returning to NMNH were also primarily affective expressions of feelings such as “intrigued,” “engaged,” “excited,” associated with the museum, the exhibits, and returning as a visitor. Description of the effect on visiting other Smithsonian museums generally involved either cognitive (interest) or affective (enthusiasm, excitement) explanations. Finally, the participants who indicated an effect on their interest in science mostly described the effect as being more interest in the specific topic of their workshop—botany, ornithology, or paleontology. All but three participants (97%) perceived at least some effect on at least one of these topics.

 **Effect on academic or career intentions.** Approximately half the workshop participants reported the workshop had at least some effect on their intention to pursue a Natural History major in college (49%); a career as a researcher (51%) or a career in a museum (47%); and a quarter (27%) on their intention to pursue a career as a science educator. Within these groups, just over half perceived high effect. However, this effect was less than the workshop effect on interest in science and museums. Of the 88 participants, 63 (72%) perceived at least some effect on at least one of these topics.

Results - Q3. What We Learned about Community Collaborative Outreach Efforts

 **Necessity for better communication about current programming and application, and selection, and support processes.** The community collaborator spoke about the lack of communication from NMNH regarding their youth programs including being relatively unaware of the opportunities at NMNH as well as the relationship between NMNH and her organization. The community collaborator also was unaware of NMNH transportation options, alternatives to online application processes, and programming available on weekends and PD days. In response, NMNH youth programming staff clarified the opportunities and application and selection processes and identified most effective/appropriate persons for contact.

Recommendation: For future expansion of the NMNH community collaborator network, establish a clear and effective communication system. Annually identify points of contact at each organization and build one-on-one in-person relationships. An effective system would include both clear messaging and follow-up to elicit (1) if messages have been accurately conveyed, and (2) how well programming and messaging are meeting target population needs.

Conclusion

This evaluation demonstrated that SCALE programming was largely successful in expanding local community access to unique, science rich, out-of-school time activities. It also successfully continued to provide meaningful and motivating paid internship and volunteer opportunities to young people from under-resourced communities and those traditionally underrepresented in science. Overall, the Teen Night Out community event appeared functioned well to introduce new teens to NMNH programming. Although evidence of a direct pipeline effect (i.e., immediate enrollment in workshops or application to leadership programs) was slim, interest in those programs was high. A community collaborator provided useful information for creating additional ways to entice these teens into programming.

The Natural History Investigation Series workshops also functioned well in the NMNH youth pipeline. They served both to generate and focus enthusiasm for the more intensive leadership programs. The workshops also functioned to heighten participants' enthusiasm for involvement with both science and museums in general and, although to a lesser extent, for science-related Participation in the workshops would provide an introduction to natural history science, technology and career,

This fourth year of evaluation of the YES! and Q?Crew Captain internships and the Q?Crew volunteer experience demonstrate successes across each of the programs' objectives. The data also revealed important areas (detailed in the executive summary and within the report), for deeper understanding and potential program improvement. Participants' qualitative feedback provided evidence that these programs change lives—as evidenced by one not-so-unusual intern who wrote:

I discovered the field of physical anthropology over the summer, and I learned much about the kinds of research occurring with the museum specimens. . . . it's very mind blowing. My mind has been blown.

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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. In its first year, SCALE programming expanded established Q?rius Youth Science Academy programming (for Q?Crew volunteers and YES! interns) to include a community science event, robust after school program offerings, and an outreach initiative intended to reach an additional 3,000 students in the Washington, DC area.

SCALE programming sought to expand access to unique, science rich, out-of-school time activities and paid internship opportunities to young people from under-resourced communities and those traditionally underrepresented in science. Thus, programming was designed to involve a pipeline of tiered opportunities (described below) to funnel participants from broad access to more focused leadership opportunities. In this pipeline, the Teen Night Out community event would serve to attract new learners. Participation in the workshops would provide an introduction to natural history science, technology and career, Participation in the leadership programs would (1) promote and affect interest in and motivation for studying science and science careers; (2) enhance comfort with communicating about science, (3) instill specific science-related content or skill; (4) enhance 21st century skills (including, communication; critical thinking; creativity; leadership; and social and emotional literacy); and (5) create both professional and peer support networks. The SCALE administrators were also interested in learning more about working with community collaborators to reach teens more effectively in under-resourced communities and those traditionally underrepresented in science.

The Lifelong Learning Group at COSI's Center of Research and Evaluation (Franklin County Historical Society dba COSI) conducted extensive 2018 evaluations of each program step in the SCALE pipeline. The evaluation was designed to determine how each step in the pipeline functioned to produce its intended outcomes. To understand and document both program quality and outcomes achieved, the Lifelong Learning Group used a mixed method approach involving online surveys consisting of psychometric, inventory, and open-ended responses; teen feedback discussion groups; and structured interviews. Thus, this report represents responses from 64 Teen Night Out community event participants, 88 workshop participants, 24 YES! interns, 15 Q?Crew volunteers; and 5 Q?Crew Captains and one community partner.

The Lifelong Learning Group (Franklin County Historical Society dba COSI) 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. Through its work with a wide range of cultural and scientific institutions, programs, and initiatives, the Lifelong Learning Group seeks to serve the field by contributing insights, building capacity, and promoting rigorous, meaningful research that supports the creation of innovative, learner-centered experiences for individuals across the lifespan. The Lifelong Learning Group of the COSI Center for Research and Evaluation is a business unit of the Franklin County Historical Society dba COSI, a 501(c)(3) non-profit organization. COSI provides administrative, fiscal, and institutional support, as well as rich opportunities for collaboration and innovation between the Lifelong Learning Group researchers and COSI's internal evaluation and research initiatives. Among the researchers, with decades of experience researching and evaluating processes and outcomes in informal learning settings, the Lifelong Learning Group researchers each contribute a unique area of research and evaluation expertise while maintaining a commitment to collaboration and shared learning across projects and disciplines.

The evaluator and first author of this report, Deborah Wasserman, Ph.D., has experience evaluating programs involving informal learning and youth development, specifically with understanding these programs through a self-determination theory-based perspective (Wasserman, 2010). Dr. Wasserman has designed and participated in the ARTLAB+ evaluations and the NMNH-ARTLAB+ art-science workshop evaluation in 2015. She is also working with a National Science Foundation funded longitudinal study of the effect of an out-of-school summer science research program on student's long-term academic and career commitment to science. To these projects she also brings extensive experience evaluating Africentric Rights of Passage programming in low-income inner-city neighborhoods.

Rebecca Nall, research assistant for the COSI Center for Research and Evaluation has worked with the NMNH youth programs evaluation data collection and analysis for the past three years. She brings to the project expertise in data management and analysis.

The Programs

The Teen Night Out @Natural History, (the broadest access) was a singular broad awareness event designed to offer a set of fun, immersive experiences that would introduce teens to science and museum careers, including the scientific research that takes place behind-the-scenes at NMNH. The event also sought to interest participants in the NMNH youth community opportunities.

Natural History Investigations Workshop series consisted of After School Workshop certificate series (science exploration), involved teens enrolling in a series of four classes that would together provide an introduction to natural history science, technology and careers. A second series, postponed due to the government shut-down in December 2018, was held in January and abbreviated to a two-class workshop.

The **Q?Crew** program provided volunteer opportunities for teens to engage in science by facilitating experiences for museum visitors to the Q?rius space, where they could interact with the COSI Center for Research and Evaluation NMNH

museum's extensive educational collections, and hands-on manipulatives. Q?Crew Captains, selected from return Q?Crew applicants, functioned in paid internships and worked to train and mentor Q?Crew volunteers.

The **Youth Engagement through Science program (YES!)** provided an in-depth science internship and professionalization opportunity designed to meet teens' needs for a more professional and immersive science experience by also providing college preparation classes, mentoring, and other opportunities to both build and use authentic scientific and science communication skills.

Evaluation Questions

Ultimately the evaluation sought to learn how well NMNH youth programs succeeded in targeting and engaging under-represented youth and increased youth interest in, identification with, comfort communicating about and gaining specific skills related to science, natural history, and cultural research. Thus, this 2018 study addressed successful achievement of outcomes listed in the SCALE program Logic Model (attached in Appendix A). Methodology built on the 2016 and 2017 evaluations so as to continue to build a database for future analysis. This study also addressed effectiveness of the Teen Science-Night event, workshop participation, collaborative partnerships, and pipeline tracking that follows future involvement of youth who attended the event. And finally it included learning about how community collaborations contributed to meeting the program goals. Each of these purposes was addressed with the following three evaluation questions:

3. How much did each leadership program (YES!, Q?Crew, and Q?Crew Captains affect participants 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; and (4) 21st century skills (including, communication; critical thinking; creativity; leadership; and social and emotional literacy.
4. How and in what ways did the Teen Science Night and Natural History Investigations workshop series function to interest teens in further Q?rius youth leadership programming, comfort with museum visits and involvement, and/or further interest in science?
5. In what ways can future outreach efforts with program partners be designed to effectively recruit teens from the targeted demographic groups?

Methods

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 focus groups.

Q1. Leadership Programs Questionnaires and Discussion Groups

Pre- and Post-Program Online questionnaires

The questionnaires consisted of one basic questionnaire developed in three formats: (1) as a pre-program questionnaire to collect baseline data from summer 2018 YES! and Q?Crew participants; (2) as a post-program questionnaire for these same respondents; and (3) as a single retrospective pre-program and post program questionnaire for continuing Q?Crew volunteers and Captains. As shown in Table 1, each questionnaire section produced data for tracking outcomes delineated in the SCALES logic model:

Table 1. How data from the questionnaire sections relate to intended outcomes.

Logic Model Short-Term Outcome	Related Questionnaire Section
1. Enhanced identity as people who know about, use, and communicate effectively about science;	Science Identity (selected items from the Science Identity scale (Cole, 2012).
2. Increased understanding of science content based on research being conducted at NMNH and its relevance to important science topics that affect their world	Science content open-ended question analyzed for NMNH-related (natural history disciplines, museology, and informal learning) content and relevance
3. Promoting and affecting interest in science and science careers	Interest in science and science careers
4. Increased skill and confidence in communicating complex science topics to diverse audiences;	Confidence in communicating complex science topics
5. Increased understanding of natural history and life on Earth in the past, present, and future, and its relevance to their lives	Same as for outcome #2
6. Increased awareness of a broad range of science careers and enhanced view of science as	Same as outcome #3

Logic Model Short-Term Outcome	Related Questionnaire Section
a viable career track and affecting identity as a science learner or practitioner)	
7. Increase in transferable workforce skills (presenting, writing, personal responsibility, communication skills, peer-to-peer mentoring, near peer teaching)	21st century skills (including, communication; critical thinking; creativity; leadership; and identity;
8. Increased skill in using scientific equipment and technology to communicate about NMNH science topics	Not measured within the scope of this evaluation.

Almost identical to questionnaires used in 2016 and 2017, the 2018 questionnaire consisted of various sections, each composed of series of scales, inventories, and open-ended questions. Section would generate data for answering Evaluation Question #1. Each section (columns in Table 2) generated data for answering specific evaluation question parts (rows in Table 2).

Table 2. Delineation of questionnaire sections used for answering the first evaluation question and its parts.

Evaluation Question	Questionnaire sections								
	Science Interest	Program contribution to academic and career intentions	Science Content gained	21 st Century Skills: Communicating science	Critical Thinking	Leadership and Personal Identity	Creative Thinking	Motivational Quality: Basic Psychological Need Satisfaction	Program Quality: Activities
How did the programs . . . affect participants in the areas of:								✓	✓
a) Promoting and affecting interest in science and science careers and affecting identity as a science learner or practitioner	✓	✓							
b) Comfort with communicating about science;				✓					
c) Specific science-related content or skill;			✓						
d) 21st century skills (including critical thinking; creativity; leadership; and social and emotional literacy; and					✓	✓	✓		

Questionnaire Sections: Documentation of Instruments and Analyses

The Q?Crew and YES! questionnaires, identical except for activities specific to each, consisted of multiple scales, each described in this section. The Q?Crew and YES! questionnaires (Appendix A) were identical except for the program names and list of related program activities. YES! interns responded to both pre-program and post-program versions. Explanations below are arranged in the order of how each questionnaire section would produce data to answer each part of the evaluation question: program quality followed by outcomes achieved.

Program Quality

Perception of Program Contribution to Outcomes

To generate data that would help administrators understand how well the various programming pieces contributed to the outcomes participants experienced, the final questionnaire question asked:

Considering all the ways you've changed and what you have learned as a [program participant], please rate the relative percentage each of the following [program] experiences contributed to your learning. (Your numbers need to add up to 100).

Participant responses for each activity were then averaged and presented as a proportion of the 100 points.

Program Motivational Quality: Basic Psychological Need Satisfaction and Frustration

To help determine how the motivational quality of the program may have affected longer-term outcomes, the questionnaire also included the self-determination theory-based Basic Psychological Need Satisfaction and Frustration scales (Chen et al., 2014). Self-determination theory postulates that satisfaction of the three basic psychological needs (for sense of relatedness, sense of competence, and sense of autonomy) will lead to high quality internalized motivation and basic psychological need frustration will lead to poor-quality externalized motivation (Ryan & Deci, 2000). Thus respondents were asked to recall their experiences of competence, relatedness and autonomy (i.e. choice making aligned with self-regulation in such a way that it is free from tension, pressure, or ambiguity) in relation to being in either the Q?Crew or YES! programs. Theoretically, and according to the basic psychological needs sub theory of self-determination theory (Deci & Ryan, 2000; Ryan & Deci, 2000), students who experienced their needs as satisfied would predictably have longer-lasting learning outcomes than those who experienced their needs as thwarted.

For both the need satisfaction and frustration scales, students responded to 9 items (three for each basic psychological need) on a five-point Likert scale ranging from 1 = “not at all true” to 5 = “completely true.” Best performance is reflected by greatest difference between satisfaction and frustration within each domain.

Outcome #1. Science identity

To give an overall sense of how feeling a science identity, participants chose one of seven Venn diagrams with the instructions: “the Venn diagrams below represent you (blue) and science (green) . Please select the image that best represents your relationship to science.” 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.

Second, they responded to twelve items on 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. The adapted scale included 7 positive items and 7 negative items to which participants responded on a nine-point Likert-type scale anchored with 1 = “describes me extremely well;” 5= “Describes me moderately well;” and 9= “Does not describe me well at all.” The positive items included;

- I spend my free time trying to find out more about science or scientific topics;
- To learn more about science, I often talk to others outside of school;
- I have a lot of pride in the accomplishments of science and scientists;
- Solving complicated scientific problems interests me;
- Solving scientific problems is interesting;
- I am interested in the way science can be used to help people;
- I am interested in the way science can be used to solve problems.

The negative items included;

- I do not think a lot about how my life is affected by science;
- I could never be a successful scientist;
- I am not interested in reading websites, articles, or books about scientific issues;
- Communicating scientific topics to others is not interesting to me;
- The logic/methods used in scientific fields are not interesting to me;
- Scientific topics do not interest me;
- I am not interested in helping others using science.

Positive items were reverse scored (so that high scores represented greater science identity) before using paired t-tests to analyze if there were any significant changes from the pre- to post-program. The positive and negative items were then averaged and compared using a paired t-test.

Outcomes #2 and #5. NMNH-related science content and relevance

An open-ended question about science content produced data to help understand how respondents think about their specific learning of science content. All three program respondents answered the following question:

In what ways has your [program] experience enhanced your science content knowledge? In your answer, please include the area of science content or the science topic your [program] experience has helped you learn most. Please be specific about what you have learned.

Responses to the open ended question regarding what participants felt they learned in their respective programs were coded into five content categories: topic, research, communication, environment, learning, and career. Definitions and examples appear in Table 3 by topic area discussed (i.e. paleontology, geology, ornithology, etc.) and counted.

Table 3. Themes, definitions, and examples used for coding science-related content.

Subject Category	Definition	Examples
Topic	Specific about or within a subject area.	ocean acidification, paleoceanography, phylogenetic, skeletons
Research	References to processes or general knowledge about scientific investigation	DNA barcoding; forams chemical analysis; lab equipment maintenance; experience working with a scientist and doing actual field work.
Communication	References to speaking or writing about science	science communication science writing
Environment	Reference to awareness, issues, or general knowledge about environmental science	climate change conservation global warming
Learning	Reference to ways of learning science; science inquiry, practices, and process skills; breadth of science; science utility; applicatoin	made science relatable; investigating and piecing together puzzle pieces; “we can use images and microscopy’s tools to better understand . . .”
Career	Reference to learning about a specific career or more generally about range of careers	“Learning these techniques encouraged me to continue to follow my dream of acquiring a science relate career.” “without it, I wouldn’t have been a science major”

Results were then analyzed to understand the distribution across categories. Distribution across areas beyond “topic” would indicate achievement of the intended outcome to increase understanding of the relevance of science content and research conducted at NMNH.

Outcomes #3 and #6. Interest in science and science careers

To generate data about participants' perceived change in general science interest in, respondents rated their agreement with eight statements (e.g., "My family has encouraged me to study science" and "I would like to have a career in science."), selected states (not traits) from the Interest in Science scale (Heimlich & Wasserman 2015). Each statements was repeated twice, first in the past tense using the phrase, "before participating in this workshop, I . . ." and then in the present tense with the phrase, "Now I . . ." Participants rated (on a five-point Likert scale, 1 = "strongly disagree" to 5="strongly agree") how much they agreed or disagreed with each statement. Following these two answers—if they indicated a change between the two time periods—they answered the additional question, "How much did your YES! experience contribute to your change?" by responding on a five-point scale: 1="none," 2= "a bit," 3="some," 4= "a lot," 5="totally." Respondents indicating no change were assigned a 1="none" score for program contribution. From the Interest in Science scale we produced mean and standard deviation descriptive statistics for the participant's ratings "now," their retrospective ratings "before," and their perceived "program contribution." Paired data was compared for significant change using Wilcoxon signed rank tests.

- Intension toward science study or career (qualitative response pre to post comparisons)

To generate data about interns' and volunteers' academic intentions, both the pre-program and post-program questionnaires included open-ended questions asking about academic intentions and career interests. Following responses to the question, "What subjects are you interested in studying in college?" respondents used a five-point scale (1= Not at all; 2= A little; 3=A moderate amount; 4=A lot; 5= A great deal) to respond to the question, "How much do you expect these subjects to involve your science interest?" on the pre-test and "How much has your [program] experience affected what you want to study in College?" on the post-test.

Following responses to the question, "Right now, if you had to choose, what do you expect your career will be?" respondents used the same five-point scale (0= Not at all; 1= A little; 2=A moderate amount; 3=A lot; 4= A great deal) to respond to the question, "How much do you expect this career to involve your science interest?" on the pre-test and "How much has your YES! Experience affected your career expectations?" on the post-test.

Responses to the open ended question about intended studies or careers were then coded as natural science (e.g., biology, physics, chemistry); social science (e.g. psychology, international relations, economics); TEM (technology, engineering, or math), or not STEM (e.g., the arts, languages) and were then counted for frequency.

Next we utilized responses to the post-program Likert-type item to create a "high" or "low" contribution score. Assigned to the "low impact" group were responses ranging from 1 to 3 (not at all to somewhat); "high impact" comprised the 4s and 5s ("a lot" to "a great deal"). By combining the impact score with the category, we created eight groups among which we described the

distribution. High contribution scores among the STEM related categories would be considered most successful.

Outcome #4. Confidence in communicating complex science topics

To generate data for assessing program contribution to participants' science communication skills, the Q?Crew and YES! questionnaires included a section to measure perception of change in comfort with communicating about science. We utilized a scale constructed from the Science Communication Competence Index, an assessment tool developed by Kulgemeyer and Schecker (2013). Respondents in the Q?Crew and YES! programs used a 5-point scale (1= very weak; 2= weak; 3= just ok, 4= strong; 5= very strong) to rate their self-perceived skill level described by each of the items. As with the other retrospective scales, they rated their perceived level "now" and "before" their program experience, and if they perceived a change, how much that change was due to their program experience.

Data were analyzed in two ways. First to determine the contribution to change scores and then to determine a general program influence score. In the first case, no-change score subjects were eliminated from the analyses. In the second, respondents indicating no change were assigned a 1="none" score for program contribution.

To compare the impact that the Q?rius programs had on participant's comfort with communicating about science, we analyzed the data from the science communication scales with mean and standard deviation descriptive statistics for the participant's ratings "now," their retrospective ratings "before," and their rating of "program contribution, i.e., how much they attributed their change (if any) to participating in the program. Individual item tests for significant change were conducted using Wilcoxon tests.

Outcome #7. Improved 21st Century Skills (including, creativity, communication leadership; and identity)

To understand NMNH longer-term impact on 21st century skills we analyzed data from the 21st century scales described above (critical thinking, and leadership and identity). Item by item contribution scores revealed more specifically where the programs had the most impact. To compare these skills, we produced mean and standard deviation descriptive statistics for the participant's ratings "now," their retrospective ratings "before," and their perceived "program contribution. As with then calculated an average "change" score where the participant's "before" score was subtracted from their "now" score. Items were tested for significant change using Wilcoxon tests.

4a. Creativity

Adaptation of Science Process Skills inventory: Understanding of creativity (21st century skill area) application to science process.

For each of 11 steps in the scientific process (e.g., “forming scientific questions” and “recording data accurately”), participants rated statements that began with the root, “Thinking creatively is *very* useful for....” To rate the statements, they used a seven-point Likert-type scale ranging from 1=“strongly disagree” to 7 = “strongly agree.”

4b. Critical thinking; problem solving; and self-assessment

The self-perception of critical thinking scales were adapted from an interpretation of 21st century skills through Bloom’s taxonomy (Lander’s, 2016). The scales include fifteen items covering knowledge, comprehension, application, analysis, synthesis and evaluation.

To measure critical thinking and problem solving, the Self-Assessment of Critical Thinking scale (Lander, 2016) which is based on 21st century learning outcomes interpreted through Bloom’s taxonomy for educational outcomes was adapted (2006) The adapted scale consisted of fifteen items covering the following six skill areas: knowledge (remembering and reciting information); comprehension (relating and organizing previously learned information); application (applying information according to a rule or principle in a specific situation); analysis (finding important points, organizing ideas, comparing and contrasting); synthesis (organizing ideas, using creativity, problem solving); and evaluation (evaluation for a purpose and self-evaluation). In this taxonomy some researchers (Duron et al., 2006) have considered critical thinking to involve the final three. Lander’s self-assessment involved the combination of each.

The adapted scale additionally included two items (ability to reflect on strengths and weaknesses and confidence to try new things) from the Positive Youth Development Inventory (Koke et al., 2007). Participants in Q?Crew and YES! expressed their perception of program effect on each of the skills listed above by responding on a five-point scale (1=“very weak;” 2= “weak;” 3= “just OK;” 4= “strong,” 5=“very strong”) to three questions about the fifteen skill areas:

- Before you were a [YES! intern/Q?Crew volunteer], how strong were your skills in each area?
- Now, how strong are your skills?
- If your skill level changed, how much do you think your YES! experience contributed to the change?

Respondents indicating no change were assigned a 1=“none” score for program contribution.

4c. Leadership and Identity

The Self-Reflection on PYD scales: Leadership (7 items), and *social and emotional literacy* (9 items; Koke, Heimlich, Kessler, Ong, & Ancelet, 2007)

Perception of the effect of the YES! or Q?Crew experience on leadership skills was measured with scales adapted from two positive youth development sources: Damon, 2004 and Koke et al., 2007. In response to statements about program effect (see Appendix A), respondents rated items within each of the five subscales on a seven-point scale ranging from 1= “not at all” through 7= “a lot.”

Feedback Discussion Groups

Feedback discussion groups with volunteer participants from both programs generated richer detail and greater understanding of specific topics addressed by the questionnaire. After the evaluators analyzed the questionnaire responses, program staff reviewed results and identified findings for which they wanted richer detail from program participants. Together with staff, the evaluator constructed questions to probe these identified areas of interest (See Appendix C for discussion group questions and responses). Students were recruited through email invitations and were given a \$40 incentive which also covered transportation costs.

Q2a. Teen Night Out Questionnaire

Teens responded to a short online questionnaire either at the conclusion of the event. An incentive for responding involved two chances to be randomly selected for receipt of a \$100 gift card .

The questionnaire consisted of the following 4 items;

The first was to rate on a scale of 1=Not at all interested to 10=Extremely interested, how much they had been interested in science over the past year via a sliding bar.

Next was to rate their agreement on a scale of 1=Strongly disagree to 7=Strongly agree, their agreement with several statements including;

1. This event made me want to visit NMNH again and see more of what’s there;
2. This event made me want to participate in more NMNH activities;
3. This event reassured me that there are groups of fellow science-interested people I can belong to;
4. This event made me think science might be more interesting than I thought.

These items were designed to quickly assess a teen’s interest in future programming or museum attendance, social interest and relatedness to other teens, and change in interest in science.

Include more detail and add copy of questionnaire to appendix.

Q2b. Online questionnaires before and after the Natural History Investigations Workshop

To answer the research question “How and in what ways the Natural History Investigations Workshop series function to interest teens in further Q?rius youth programming, comfort with museum visits and involvement, and/or further interest in science?” we conducted analysis of pre and post program questionnaires. The results are split into six sections: (1) Pre-workshop intentions (reasons for attending) and programming (Teen Night Out attendance); (2) workshop effect on participant’s interest in applying to Q?Crew or YES!; (3) workshop effect on participants’ attitudes toward visiting or being involved with science and museums; (4) Effect on Further Interest—including further interest in science; science identity, and natural history interest; (5) Science Identity; and (6) Natural History interest.

We analyzed data from participants’ before and after-program responses to online questionnaires. The pre-program questionnaire included the following sections:

1. Reasons for participation. Open ended question asking participants to describe why they chose to participate in the workshop series.
2. To evaluate the pipeline effect of the Teen Night Out community event, two questions regarding Teen Night Out. The first asked if the respondent attended the Teen Science Night “last November” and if so, how important attending the Teen Science Night was to signing up for the workshop series. The response scale ranged from 1=Not at all important; 2=Slightly important; 3=Moderately important; 4=Very important; to 5=Extremely important.
3. To evaluate the effect of the workshops on recruiting for more intensive involvement, two Likert-type scale response items measured interest in applying to the Q?Crew and YES! programs.
4. To assess the program’s ability to promote and affect interest in science and science careers, participants responded (on a scale of 5= Extremely high; 4= High; 3= Moderate; 2= Slight; 1= None at all) to a statement about the possibility of pursuing a major or career related to Natural History.
5. Finally, to assess respondent’s science identity as someone , participants responded to 14 items adapted from the Science Identity Scale (Cole, 2012) described in above in Q1 methods.

The post-program questionnaire included the following 10 sections

The questionnaire began with eight sections, each asking for a description of the workshop effect on one of eight outcomes. The first four involved attitude toward science and museums: (1) interest in studying science in school; (2) interest in visiting NMNH as a visitor; (3) interest in visiting other Smithsonian museums; (4) general science interest. The second four involved further academic and

career interest: (5) interest in pursuing a natural history major in college, (6) interest in pursuing a natural history subject in a career as a researcher; (7) interest in pursuing a natural history subject in a career as an educator; and (8) interest in pursuing a career working in a museum. In each section participants responded to the following at least the first of the following 3 questions:

- a. For each of these outcomes, respondents first answered if the workshop had “at least some effect.”
- b. If respondents selected that the workshops had at least some effect, they were then asked to complete an open ended question to the prompt “I will feel more...”
- c. Finally the “at least some effect” respondents selected, on a Likert-type scale (1= a bit . . . 5=A great deal) how great of an impact they felt the workshop had on that particular outcome.

Section 9. Next, respondents responded to the question, repeated from the pre-program questionnaire, about their interest in applying for Q?Crew and YES! programs.

Section 10. Finally, respondents’ science identity was again measured using the adapted Science Identity Scale (Cole, 2012).

Coding the open-ended questions. Questions about the reason for attendance and workshop outcomes each involved open-ended questions. Analyses of these responses involved emergent thematic coding. Across all eight outcomes and the reasons for attending, responses could be categorized into common themes, each described in Table 4, beginning with the four most frequently expressed. These categories were used to summarize comments regarding each of the eight potential workshop outcomes and the reason for attending. Summaries are presented in the relevant sections below with detail for each listed in the appendix.

Table 4. Emergent themes used to code reasons for attending and explanations of outcomes.

	Theme	Description
Most Frequent	Cognitive	Reference to knowledge or interest in learning including current or future positive attitudes toward cognitive pursuits of relevant topics such as how museums function, understanding the scientific process, or more in-depth knowledge of a specific topic (e.g. forensic anthropology).
	Affective	Reference to changes in moods or emotions such as feeling more comfortable, open, or excited. These affective states often were associated with specific triggers such as higher confidence in skills or knowledge, greater engagement in natural history or museology related topics, or openness to exploring new topics, careers, and majors.
	Interpersonal communication	Comments that indicated excitement or interest in communicating new knowledge or skills to peers, visitors to the museum, or family members.

	Career oriented	Reference to interest, opportunity, or intention toward natural history or museology-related career opportunities. These responses often acknowledged that the workshops exposed participants to careers that they didn't previously know existed and gave them realistic pictures of what careers in these fields look like. These career opportunities included such professions as researchers, educators, and museum personnel.
Less Frequent	Utility	Reference to specific skills gained (e.g. practice with microscopes), real world experience, or hands-on practice. These responses also included awareness of how the scientific process, science skills, or science topics applied to daily life.
	Past Experience recollection	Reference to prior NMNH classes or museum visits.. These memories served to bolster reasoning for either motivation or effect.
	Future participation	Reference to interest in NMNH programming or events. These responses often mentioned hope or interest in participating in the YES! internships. Sometimes they also included hope that participating in the Winter Workshops would bolster resume and aid chances of being selected to for the internship program.
	School or curriculum Referral Source (specific to reasons for attending)	Reference to credits obtained usually for homeschooling Descriptions of how participants learned about the workshops. Some of these included advertisement or researching the website or flyer, parents signing them up, or a friend's or school's recommendation.

Q3. Community Collaborator Structured Interview

The interview questions centered on understanding how the after school program staff sees NMNH as an institution and how NMNH might become a better partner. After being recruited via email on recommendation of the NMNH program coordinator, the questions included the following;

1. Describe what you know of the NMNH youth programs and how they function (or fail to function) as a resource to the youth in your program. [prompt for YES!, Q?Crew, Workshops, and Teen Night Out; In what ways do you understand NMNH youth programs to be a resource to the youth in your program]?
2. In your program, about how many students each year would you say would be interested in/could benefit from NMNH youth programs? Does the number of those who would benefit differ from the number of those who are interested? If so, what makes the difference? Kind of person or list?

3. What conditions make it difficult/over-challenging/uninteresting for youth to consider participating in NMNH programs? applying for them?
4. What strategies could the program use to best appeal to or reach out to the youth in your program? Prompts: send speakers? Help with applications?
5. What could NMNH do to help you know the program well enough to talk about and promote it? [Prompt: send more information; send regular updates about accomplishments; invite you to observe, send a representative to explain the program to your youth participants.]
6. What other similar opportunities are available to the youth in your program? How do you choose which to promote and for what reasons?
7. In what ways would you use the term "community partner" to describe your organization's relationship with the NMNH youth programs?
8. NMNH is looking to reach the youth in your programs who can benefit from NMNH internships, research opportunities, and volunteering. More than just seeking referrals, NMNH is wanting to be an active partner with you in providing quality opportunities for these young people. Youth program staff are wanting to understand ways they can function as an authentic collaborative partner with you. Can you think of ways they might work with you or your organization to best function as a resource? Can you think of other collaborative roles they could or should assume?

Finally, time was allotted at the end for the interviewee to respond with any final thoughts or questions.

The Samples: Description of the Data

Q1. Leadership programs (YES!, Q?Crew, and Q?Crew Captains

In total, 24 of YES interns, 15 of Q?Crew volunteers, and 5 Q?Crew Captains responded to online questionnaires.

Table 2 delineates the number of respondents, within each of the programs, who answered questions in each questionnaire category.

Table 5. Count of YES! And Q?Crew respondents to questionnaire subscales by program.

	YES!	Q?Crew	Q?Crew Captains
Interest In Science (paired)	24	15	4
Academic Intentions	24	15	5
Career Intention	24	15	5
Science Content Knowledge	23	14	5
Critical Thinking	22	15	4
Science Communication	21	14	5
Basic Psychological Needs	23	14	5
Leadership	22	15	5
Creative Thinking for Science (paired)	23	12	5
Learned from Program	23	15	5
TOTAL	22	12	4

Discussion Groups. 5 YES! interns (2 second year and 3 first year) participated in the feedback discussion group.

Q2a. Teen Night Out

A total of 72 teens responded to the questionnaire.

Q2b. The Workshops

A total of 96 participants attended at least one of the three workshops. Of this total, 88 participants (91%) provided both pre and post-program responses representing 21 from the Botany workshop, 26 from the Ornithology workshop, and 41 from the Forensic Anthropology workshop. Only responses from participants with both pre and post-program data were included in the analysis.

Due to federal constraints, the workshop series originally planned for the end of 2018 and beginning of 2019 was postponed until February of 2019. It was also greatly reduced to a single workshop from the planned multi-workshop offering as in Spring 2018. A total of 19 participants attended the workshop with 16 providing pre and post data. Only responses from participants with both pre and post-program data were included in the analysis. Of this group 7 had participated in the 2018 spring workshops.

Q1a. YES! Results

The evaluation question: Q1. How much has each youth program affected participants (both first year and repeated year) 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)?

Results in this section area arranged in order of the evaluation question area.

What We Learned about YES! Effects on Intended Outcomes

Program Activities. All but one of the YES! program activities contributed equally to “all the ways you have changed and what you have learned.” To the credit of this mentorship program, the one exception, “relationship with your science mentor”, contributed most.

Motivational Quality. Satisfaction of interns’ need for sense of autonomy has been high and climbing over the past three years. This trend portends well for the program and for durability of positive outcomes. Need frustration, while generally low and reduced from 2016 to 2017, rose again in 2018. Sense of competence followed a similar pattern. Possible reasons and recommendations offered by intern feedback involved mentor selection (scientists who “know how to talk with teens”) and intern selection (emphasize openness to learning over accomplishment).

Science Interest. YES! Interns perceived themselves as experiencing a significant increase in their interest in science and that their YES! experience worked with other life factors to create that difference. The YES! experience contributed to that change most highly in the area of family encouragement and family academic interest.

Recommendation: Recognize the impact of the Smithsonian brand and paid internship on the amount of support students receive from their families.

Science Identity. Overall, most interns perceived themselves as either maintaining or strengthening their science identity. They particularly demonstrated change in the area of being aware of how science impacts their lives.

Academic and Career Intentions. Overall, YES! has greater impact on academic intentions than on career intentions. Across both, the internship functions to reinforce rather than change these intentions.

Science communication. Interns greatly improved their science communication skills and largely attributed that change to YES!

Science Content. YES! intern’s content learning ranged beyond learning about specific topics which comprised only a quarter of the topics reported. Equal amount of learning occurred in the areas science process and inquiry and conducting research. Content learned also included science communication, communication in general, and learning about careers. A large majority of interns also commented on and explained the relevance of this new understanding to their personal lives.

Leadership and Identity. The YES! experience contributed to interns Leadership skills and personal identity. They particularly attributed to YES! greater ability to think about how their actions affect others ; greater ability to work as part of a team or group; being willing to take on a leadership role, and being able to accept responsibility.

Critical Thinking. Interns perceived themselves as having improved significantly across all aspects of critical thinking. Most attributed to their YES! experience was “predicting how well I will do a specific task,” and “Applying what I learn to solving problems.” **Creative Thinking.** Interns’ appreciation for creative thinking across the steps of the scientific process was relatively high and remained unchanged over the course of the internship. There were no differences between year groups.

YES! How We Know

Program Quality: Interns’ Experience of the Internship

Outcome effects described in this report first need to be understood in the context of how program participants, i.e. the interns, experienced the program. For that reason in this section we provide descriptions of how interns experienced the both the balance of program activities and the program’s motivational quality.

How the Activities Balanced to Support Outcomes

All but one aspect of the YES! program contributed equally to the positive changes and learning interns’ experienced. Each of these activities contributed between seven and eleven percent. Figure 1 illustrates the distribution. To the credit of this mentorship program, the one exception was the relationship with the science mentor--which interns jointly rated as contributing 20% to “all the ways you have changed and what you have learned.”

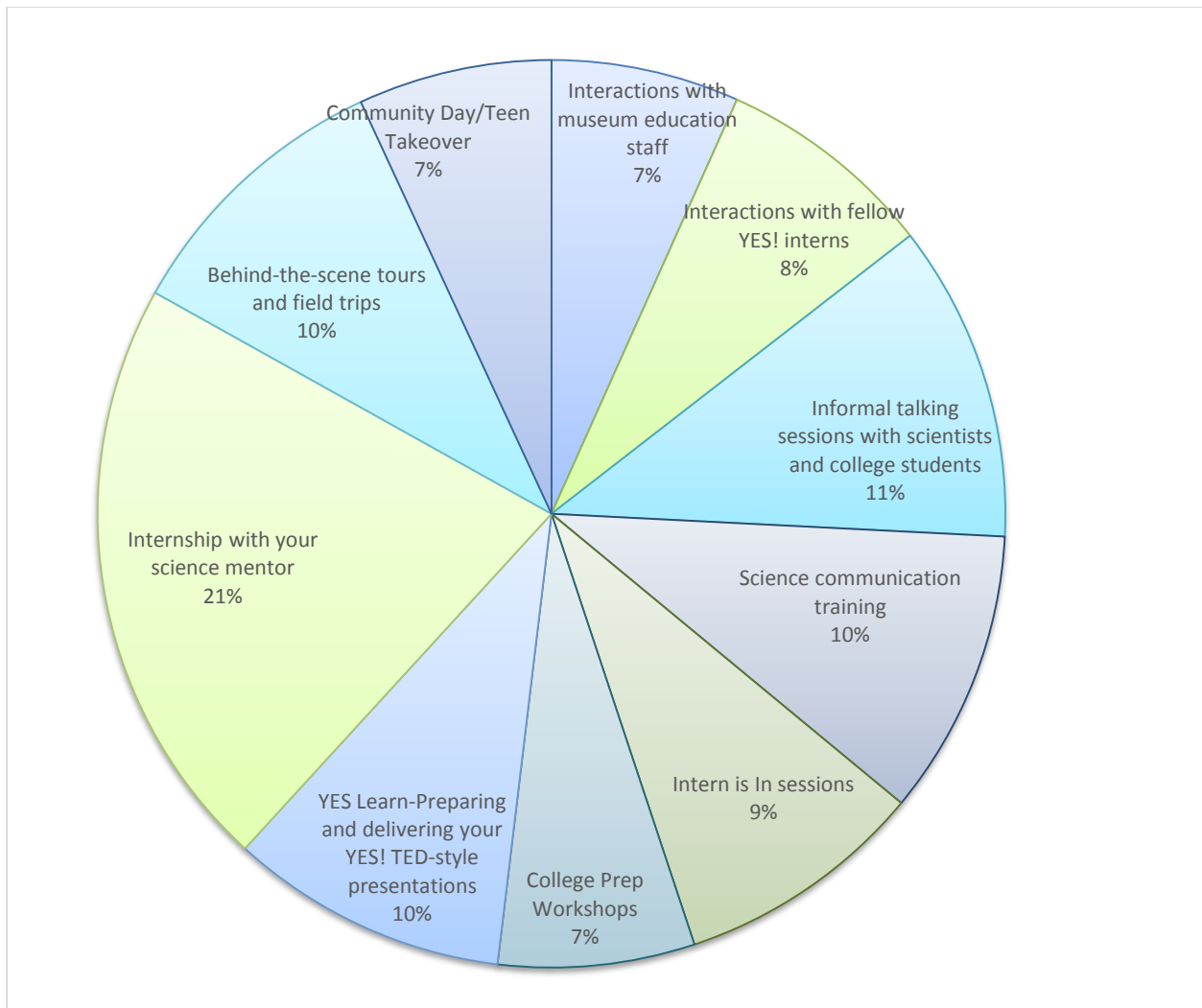


Figure 1. Distribution of how YES! interns perceived YES! activities as having contributed to the outcomes they achieved.

In the feedback discussion group, participants provided richer detail of this attribution by answering the question, *What did mentors do to help you feel competent, related, autonomous?*

Clearly some close relationships were forged that will have a lasting effect. Consider for example the gratitude and closeness demonstrated in these comments:

I loved my mentors. That's what will be written on my tombstone.

I was in conservation. My mentors brought me into their world, like at lunch with their colleagues, they treated me like a colleague too. They introduced me to the people [in their professional circle].

*They would say how good a job we were doing/ When they corrected us, it was respectful. Treated us like a colleague, **like by** calling each other by first names.*

I was part of their summer, rather than vice versa. They would stop their workday [to] include me and my partner.

Participants also acknowledged that mentor relationships could be inconsistent, but for those interns and those times where the mentor relationship was less helpful, staff educators filled the gap.

They took me to restaurants. I think they were told, "Go take your kids to dinner." Some did; some didn't.

[the Microscopy Educator] took us out. That was more important than going with a scientist.

[The staff educators] made me feel like my work was important. I felt like I was changing science. They showed me how my research will be used in real life applications. They could explain so easily (unlike the bug guy).

We loved Katie, Josh, Hannah, [the Microscopy Educator] and [the Youth Internship Coordinator]. If you had a bad day with your mentor- there were others to balance it out.

Motivational Quality

In line with a program that successfully motivates youth development, satisfaction of the basic psychological needs for sense of competence, relatedness, and autonomy were high and frustration of those needs were low (both on a 1-5 scale). As illustrated in Figure 2., although not analyzed statistically, observation of trends over the past three years revealed some insight into program quality. First, satisfaction of interns' need for sense of autonomy has been inching upward while frustration of that need has been declining. This trend portends well for the program and for durability of positive outcomes. On the other hand while satisfaction of sense of relatedness has remained high, frustration, which improved last year, rose again this year. Sense of competence followed a similar pattern. Although low, frustrated need for sense of competence reduced last year but rose again this year; a pattern reflected in satisfaction of the need sense of competence which as a corollary increased a bit in 2017 but decreased again in 2018.

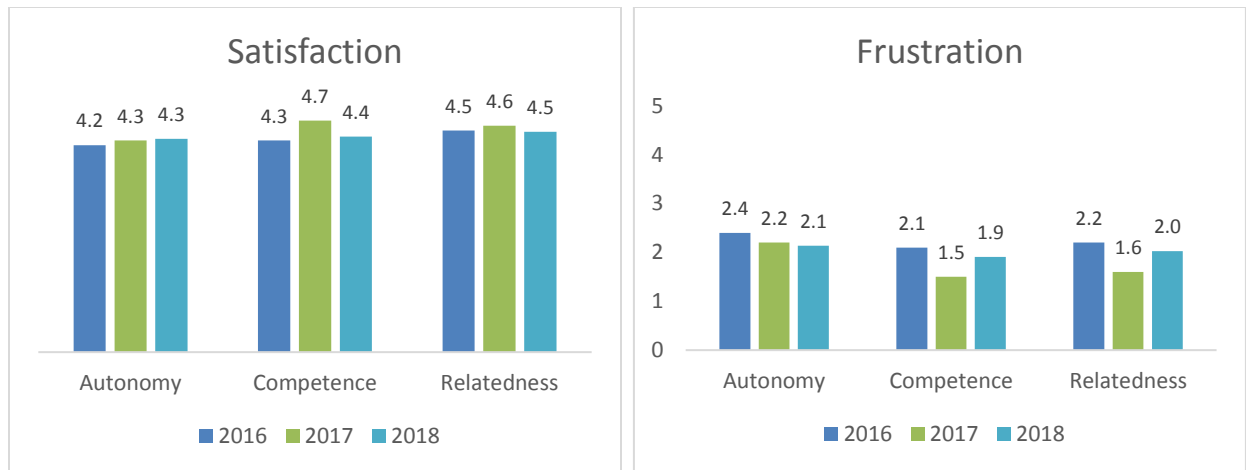


Figure 2. YES! interns’ reported basic psychological need satisfaction and frustration across 2016, 2017, And 2018 program years.

While these patterns are in line with a program that successfully engenders internalized motivation, the fluctuations within them can provide “head’s up” direction for fine tuning to the program’s administrators and educators. To help understand these patterns, 2018 discussion group participants provided feedback to the following explanation and question:

Note that sense of autonomy is inching it's way upward, but sense of competence and relatedness this past year looked more like two years ago. Also note that need frustration hovers around “somewhat disagree.” Talk about what you think might explain that finding.

The discussion that ensued centered two areas of explanation – one addressing sense of competence via relationships with NMNH scientists (some, not all as will be seen in the discussion of mentors below). The other involving peer relationships. Both surfaced important concerns.

The following comments involved somewhat frustrated relationships with the scientists:

[I felt like they gave us] rushed explanations, [like when my mentor was explaining] pinning moths. I don’t like bugs . . . we had a class on pinning beetles [but] we were pinning moths and I was touching it wrong. I had no idea what I was doing. Someone else was saying “nice job.” But not to me. The guy was doing it, but he wasn’t helpful . He was helping people who knew more.

A lot of the scientists are anti-social; cold and not teaching. [They] assume [you already have] understanding. . . . [The scientists] assumed we all knew [the background to what they were trying to teach]. Sometimes I had to pretend I knew. Then I did outside research on my own—that was sort of annoying. But I figured it out.

And their recommendation: “find people who know how to talk to teens.”

The discussion also addressed some tension within the group. “As a whole group we weren’t all united and embracing,” one participant said. Another explained last year’s lower relatedness frustration with the explanation, “Last years the 1.0s, 2.0s and 3.0 s were separate.” And then introduced with her perception of the problem that created more frustration this current year: “This year the issue was with the people who were less interested.”

Others agreed. The group consensus was that a few less committed participants had an effect, though generally small, on the whole group. Phrases used to describe these individuals included “lack of interest;” people with “egos” and a sense their opinions were ‘better than’ others’ opinions; people with attitudes that they already were expert and had little to learn. One person said,

They didn’t understand the purpose; [they saw what they were asked to do as] meaningless tasks; they didn’t pay enough attention to understand.

If my partner wasn’t interested, I’m annoyed.

And this commitment has an effect on others: *If my partner wasn’t interested, [then] I’m annoyed.*

Picking up the “better than” thread, one participant provided the following example:

Belief systems clashed sometimes. For example there was an issue between two people—one who could see multiple perspectives, multiple ways of seeing the world—spiritually as well as scientifically. The other would only accept a science perspective.

And another recommendation:

So when they’re reviewing applications, they should consider, “Will this person get along with others? Will they appreciate the learning? Who needs what?” Then choose the person who says “I know a little; I want to know more” and not the person who says “I know this already.”

A third explanation was mentioned but not pursued by the group: “There may also have been an issue between seniors and freshmen.”

Intern Feedback Discussion of How Boot Camp Affected Motivational Quality

Discussants also reflected on their preparation “Boot Camp” week, responding to the following prompt and questions:

Boot Camp. *Talk about how the preparation week affected your basic psychological need satisfaction (your sense of competence, relatedness, and autonomy) when you*

came to the program. What worked? What particularly helped? What didn't work? What was daunting? What suggestions do you have to improve the prep week for next year?

The discussion revealed both strengths and challenges of the Boot Camp week. In many ways the experience strengthened participants' sense of well-being in the program both in terms of comfort, and relatedness. For example, one discussant talked about how it relieved her anxious feelings about starting in a new position at such a large and respected institution. For her, "it made the big look small" and "no longer intimidating."

Discussants also spoke of how the week served to create relationship and comfort, specifically referring to the effectiveness of the scavenger hunt. She said,

One day—the scavenger hunt--was really fun. I missed it this year (2.0 didn't do it; 1.0 did): we got to meet people; explore the museum; and it was fun.

Team building was also important, and the discussants noted that the team building experiences were valuable but shouldn't end with boot camp week: Her recommendation came as a way of dealing with a personally felt frustration: *It should be repeated throughout -- Like I don't even remember everyone's names.*

But despite these concerns all appreciated the value of [the Youth Volunteer Coordinator's] "great improv exercises."

Discussants provided additional concerns with that first week experience along with recommendations for how improve it. One discussant believed that the day spent addressing how to interact with visitors was least valuable. She said,

One day [during the week] was about visitors, but [in our internship] we didn't interact with visitors that much. I think I fell asleep [during the sessions that day]. I never used that information. It was irrelevant.

How to dress also emerged as a topic worth noting.

First day I came dressed up; some others were dressed up and some were people in jeans. How people dress shows you personalities.

They told us to dress "business casual." But what is business casual???

Content, especially for returning interns surfaced as a concern, generating the following two recommendations:

2.0s had to repeat lessons a lot of repeat. Maybe side field trips or same ones but with different activities would work better.

Keep [the Microscopy Educator] as the 2.0 mentor. And keep 2.0s together. We learned a lot from each other.

Q1a-1. Effect on Interest in Science, Science Identity and Science Careers

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 that change. Second was to assess interns' current ideas for academic and career plans for science involvement and again, to document how much they believed their YES! experience contributed to those plans.

Science Interest

YES! Interns perceived themselves as experiencing a significant increase in their interest in science in several ways (across all items in Figure 3, but particularly strong for those circled with blue ovals). A paired-samples t-test showed a significant change in average science interest before ($M=2.93$, $sd = 0.62$) to average science interest "now" ($M=4.36$, $sd = 0.62$; $t=6.67$, $df=22$, $p<.01$). Per item responses arranged in order of significance (from significant to not) are shown in Figure 3. Significant change occurred across 7 of the 9 items. The average attribution of change to the YES! experience was 2.9, i.e. between "a bit" and "some," indicating that YES! was working in conjunction with other influences in these young peoples' lives. Of note is that the greatest perceived contributions were to the areas of family interest in science academically and in family encouragement to study science.

Interpretation. The YES! internship contributed, probably in conjunction with other life influences, interns' interest in science. The YES! experience contributed to that change most highly in the areas of family encouragement and family academic interest.

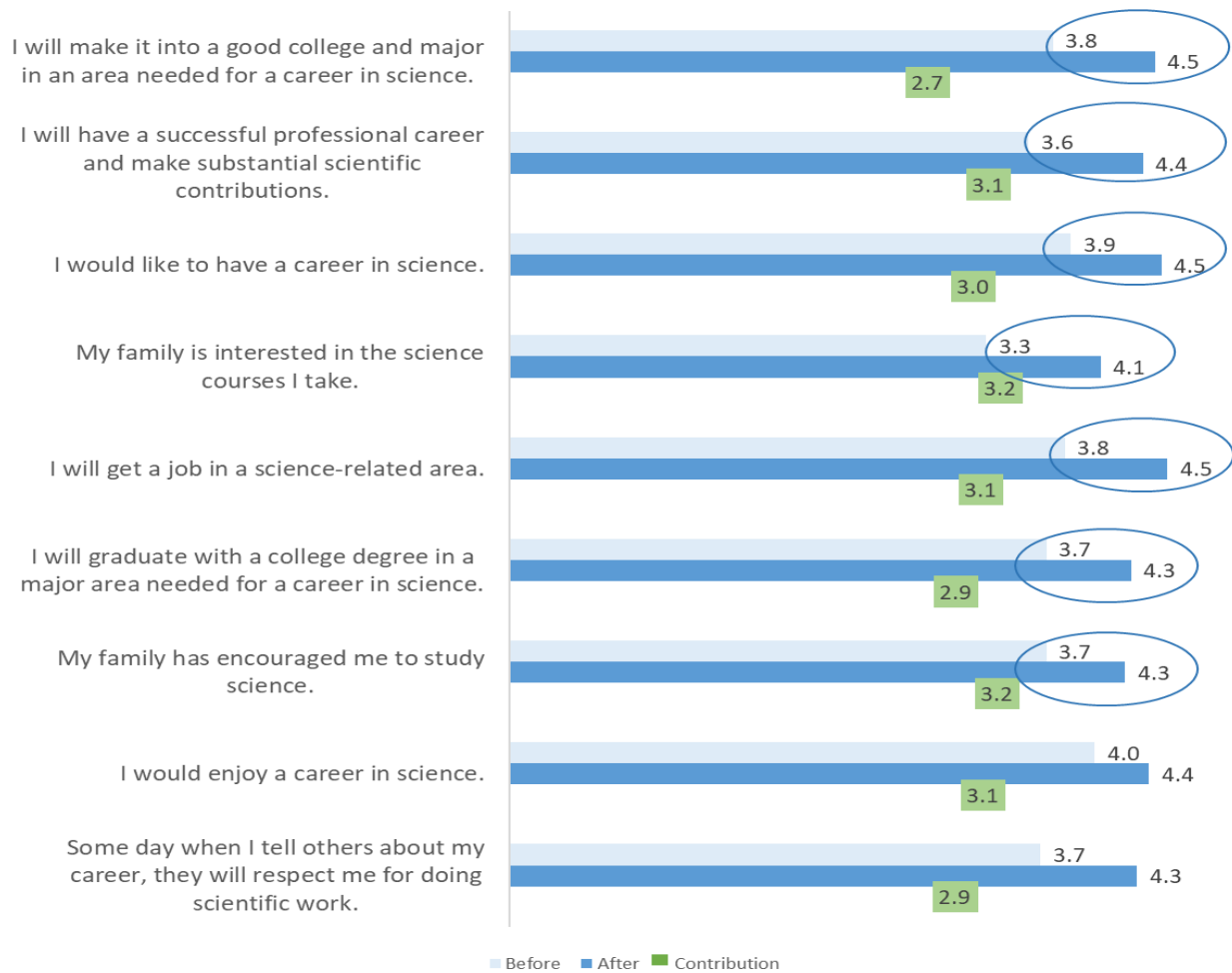


Figure 3. Before, Now, and contribution scores reported by YES! Interns (arranged in order of significance probability)

Science Identity

Overall, most interns perceived themselves as either maintaining or strengthening their science identity. Curiously six of the 23 experienced themselves as a bit less science identified, i.e. one step in the Venn diagram overlap; Figure 4Figure 5), with two from that group less so by two steps.

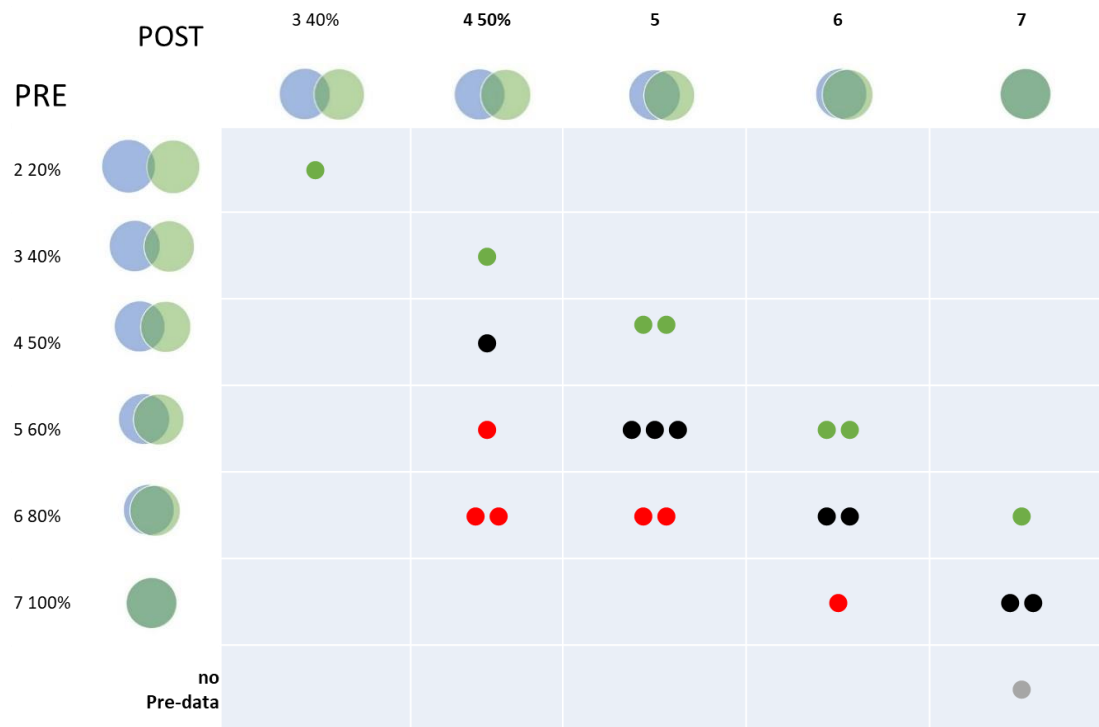


Figure 4. Comparison of YES! interns' personal identification with science from pre to post internship

Programs administrators chose to further explore this curious finding with discussion group feedback. Thus, feedback discussion group participants responded to the prompt and question:

Some students became less science identified. Talk about what you think explains this finding. How do you think those findings relate to the improved science identity findings in the per item detail.

Follow up in the group discussions led to various possible explanations, two of which reiterated points that surfaced in the motivational indicators (basic psychological need satisfaction and frustration) discussion described above. First, and less prominently, they discussed the ambivalence that occurred for some interns due to strained mentor relationships. One discussant noted feeling both encouraged and discouraged about science saying,

[I] found it easier to communicate science because of the Reach 100 [referencing the program's expectation that students would share their research findings with at least 100 people], but in the actual internship, the mentor relationship was strained.

Another discussant reiterated the important role of mentors to those whose science identity improved, saying:

I valued the internship so much. My mentor kind of changed my project to be what I'm interested in (tech programming). Toward my interest in tech programming. That's why a good mentor is so important

Second, and at greater length, discussants spoke about the handful of less committed peer who “lost interest.” The discussant consensus was that they could name the interns they believed the ones who perceived themselves as less science identified. Whether their guess was accurate could not be known for obvious confidentiality reasons, but their description of these people’s experience was still relevant.

Reflecting their comments from the motivation discussion, they described the interns in this group as people who felt they “*already know enough*” and didn’t need to learn more. For them, “*learning wasn’t a priority [and they would say,] ‘I don’t really need to know this.’*”

The discussion moved to the topic of intern selection criteria and attitude differences. More specifically, they had noticed during the program’s first week that some interns “*didn’t arrive with as much interest*” and were “*not very adult.*” These were the people who

... didn’t treat [the internship as a job. [They would be] hanging out on their cell phone, returning late, taking long bathroom breaks. They treated it more like summer camp than a job.

Another discussant postulated that the lack of interest may have been due to expecting the 2nd year internship experience without putting in the first-year work. She said:

Their expectations were too high, for example, they expected they would be working in a lab with an actual scientist. But 1.0 [first year internship] involves a lot of learning. It’s more about exploring. 1.0s started with learning the proper foundation. As a 2.0, you learn even more, you’re even more engaged. In 1.0 kids come in saying “I already know this.” But they have to learn. Maybe they don’t like being treated like children, but it’s necessary to get that foundation. The 2.0s felt more connected.

Discussants then turned their attention to ideas for what would help and generated recommendations. Their comments were as follow:

[Program staff need] to expect more of them. [They needed a] reminder that [being in the YES! program] is still a job. Field trips kind of confuse that.

[Administrators] need to be more careful about the people they choose [as interns].

Make it look stricter than it is. That way you get people really interested and committed.

Make sure people have a direct interest in science.

Connect it more with college.

What's important is their interest in STEM and being committed to a professional work ethic.

Responses to the science identity scale provided a more detailed view. Overall, there was some evidence that the YES! experience strengthened interns' science identity (pre $M=7.3$, $sd=1.1$; post $M=7.6$, $sd=1.1$; $t=1.7$, $df=23$, $p=.09$). Responses to the positive items on the identity scales did not significantly change (pre $M=7.1$, $sd=1.3$; post $M=7.2$, $sd=1.3$; $t=0.48$, $df=23$, $p=.63$); however, interns became significantly less negative (pre $M=2.5$, $sd=1.2$; post $M=2.0$, $sd=1.0$; $t=2.3$, $df=23$, $p=.03$).

Per item detail can be found in Figure 5. After the program YES! interns' responses showed them to be significantly less identified with not thinking about how their life is affected by science. In other words, **they became more aware of the relevance of science in their lives**. Interns reported the lowest amount of agreement with the statement about spending their free time finding out more about science and science topics. Their highest average agreement was with interested in the ways science can help people, that science topics interest them, and that they are interesting in using science to help other people. Overall, interns reported higher agreement after participation in YES! than prior.

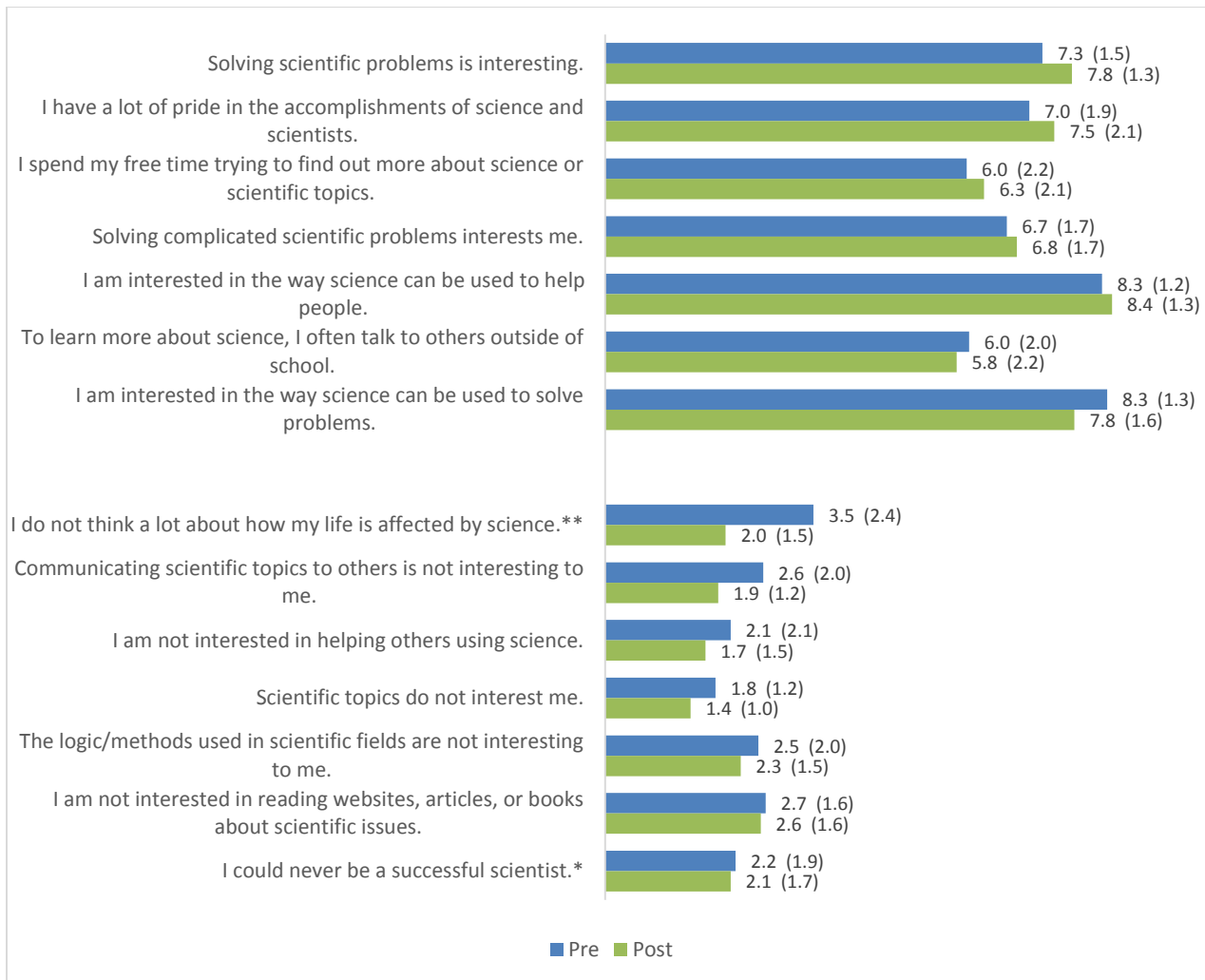


Figure 5. YES! Intern science identity items before and after participation, circle denotes significance at $p < .01$, * show items that were reverse coded

Also of note are the areas where interns who self-identified as having strengthened their identity (as shown in Figure 3 above) most experienced that change. Figure xxx below illustrates ranking of change across the items by self-perceived identity groups. These areas had to do with feeling pride in science accomplishments; using science to solve complicated problem and to help others. They also became less identified with not thinking about how science affects their lives, that they couldn't find success in a science career; and that they weren't interested in science-related issues.

Academic and Career Intentions

As illustrated in Figure 6, half of YES! Interns reported a high effect of their internship experience on their academic intentions. Of the interns who reported this high effect, about two thirds were

interested in majoring in natural science. The remaining four students' academic intentions divided equally between medicine, STEM (not natural science), social science, and not STEM.

Most interns reported no change in the subject of their academic intentions. Of those who did change, all changed laterally, meaning they changed to a different area of a science related field including one change to social science, two to medicine, and one to a natural science. More detail can be found in Figure 7.

As illustrated in Figure 8, about a third (29%) of interns reported high program effect on their career intention. Of the seven interns who experienced high effect, four intended to pursue medical careers. The remaining three intended careers in with natural science, TEM (not natural science) and not-STEM.

Whether high or low impact, most interns remained consistent in their career intentions. Of those who did change, two changed to be not-STEM related and 2 changed laterally to a different TEM (not natural history) career. More detail can be found in Figure 9.

The majority of low effect career plans involved pre-med. Of those who reported high effects on their academic intentions, most were medicine (17%) while natural science, not-STEM related, and technology, engineering, and math each had one intern.

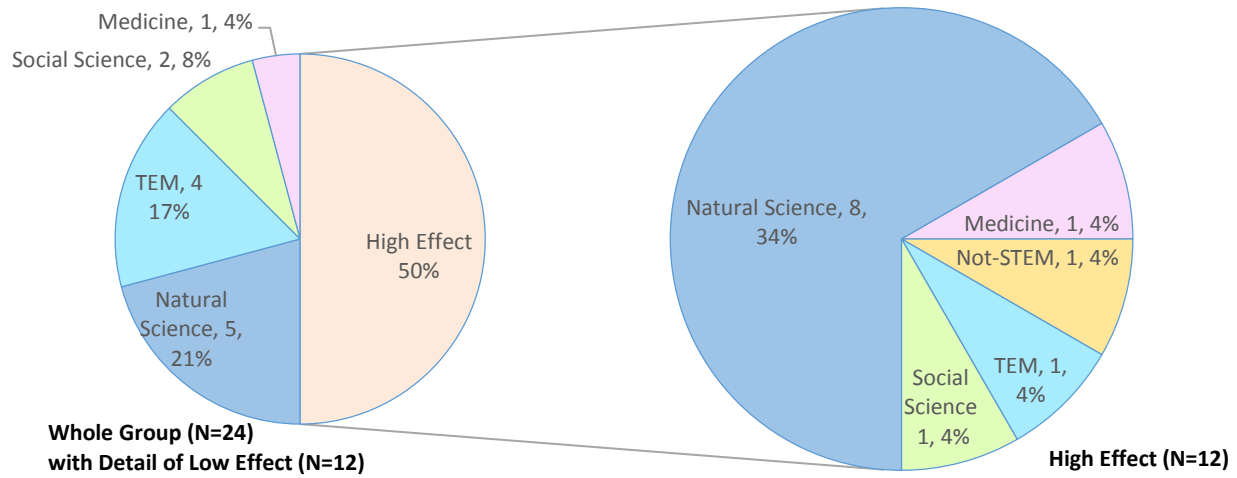


Figure 6. Distribution of academic intentions for YES! Participants divided by intern perception of low and high effect on their intentions.

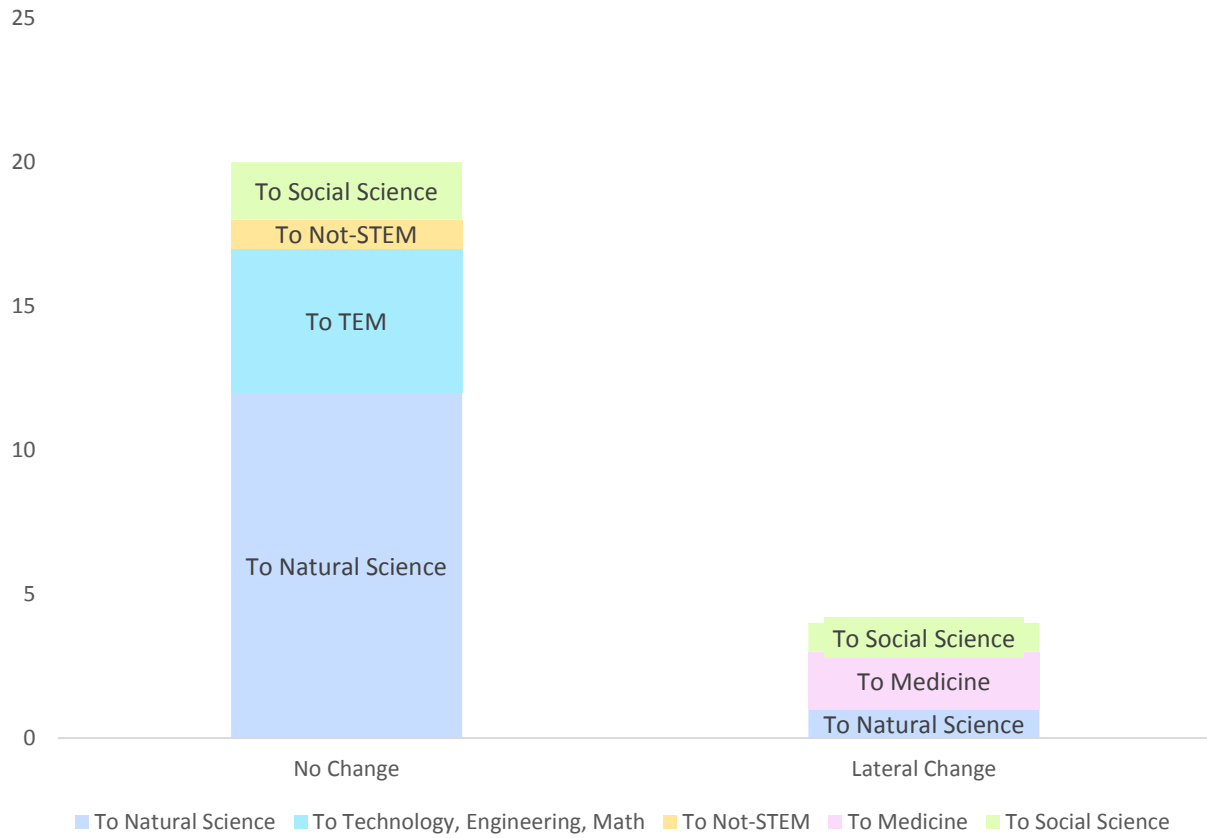


Figure 7. Changes in academic intentions for YES! Participants.

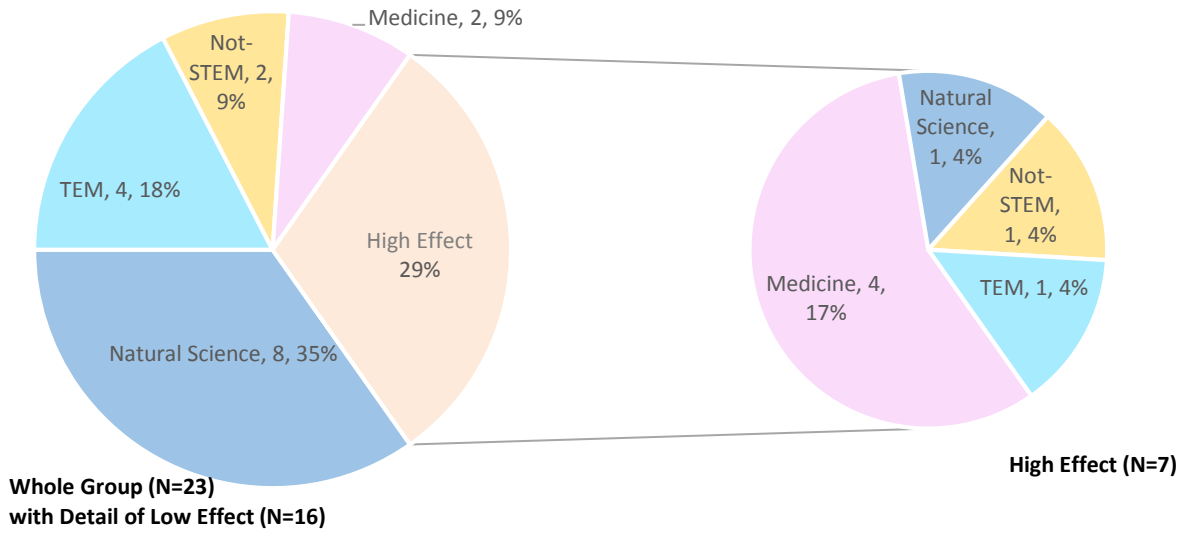


Figure 8. Distribution of career intentions for YES! Participants divided by intern perception of low and high effect on their intentions

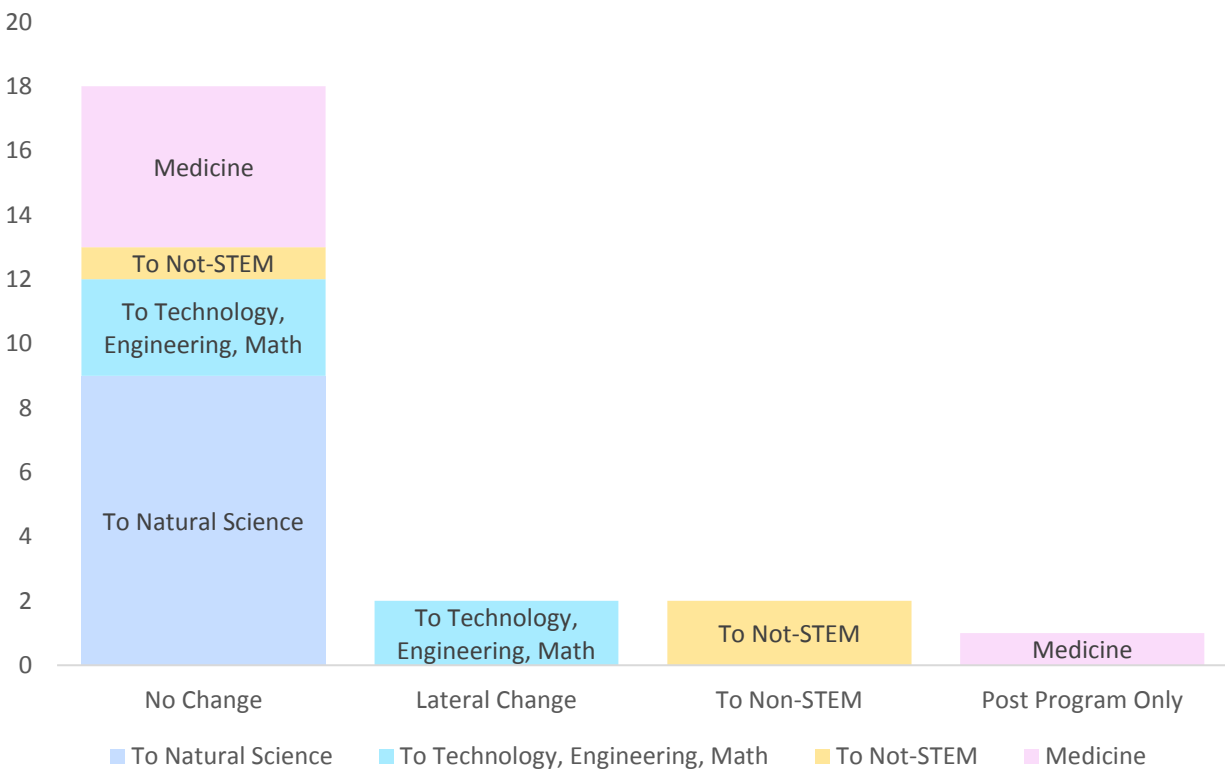


Figure 9. Changes in career intentions for YES! Participants.

Interpretation. These patterns of pre-program to post-program academic and career interest indicate that overall, YES! has greater impact on academic intentions than on career intentions. Across both, the internship functions to reinforce rather than change these intentions.

Specific Skills: Science Content

Responses to the question about areas of science content in which interns learned most distributed well across the six coded topic areas (for definitions, see above, methods for outcome #2, Science Content). A distribution different from all or most responses in the “topic” category would be considered successful. In this case responses about science learning (science inquiry, practices, and process skills, 27%) occurred equally as often as topic with the remainder of content learning spread (in order of frequency) between research, (i.e. learning about the research process or conducting research), environment, communication, and career. All responses coded as “topic” related to natural history. Responses were also coded for “personal relevance” of increased understanding of “natural history and life on earth in the past, present, and future. Eighteen of the 23 responding interns (78%) made reference to personal relevance. This finding reflects the significant change in personal relevance found in the science identity measure (described above).

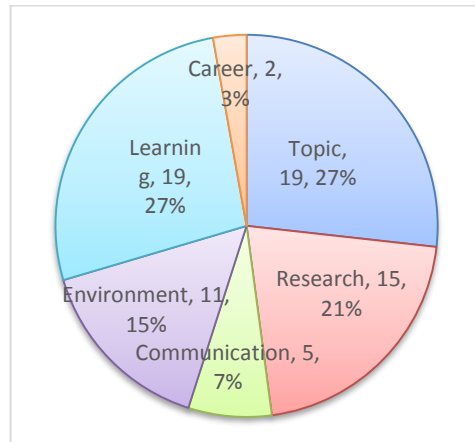
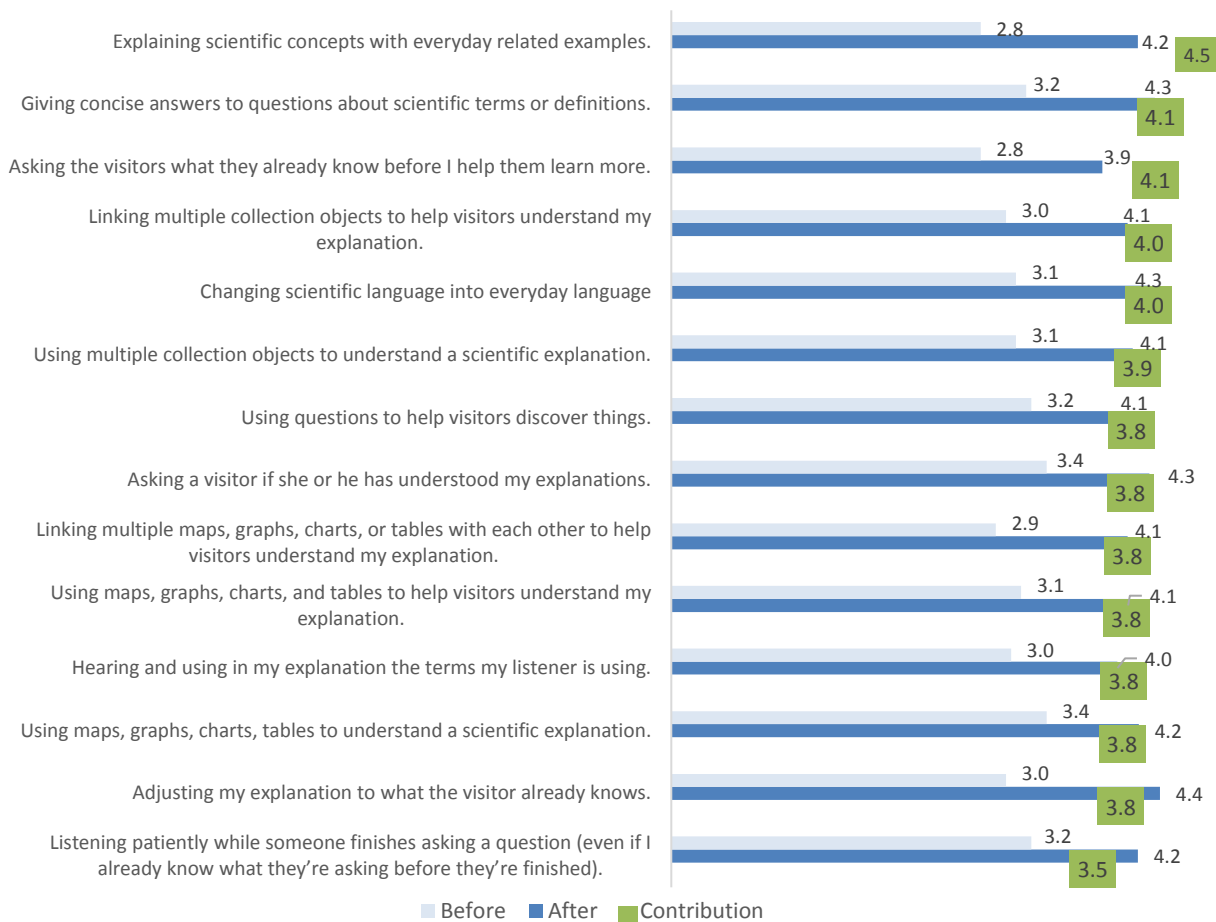


Figure 10. Distribution of content categories.

Comfort with Communicating about Science

Results of the science communication scale demonstrated that interns improved their science communication skills and largely attributed that change to YES! Interns perceived themselves as experiencing significant change across all items, generally rating themselves as between “weak” and “just ok” before the program to between almost “strong” and “very strong” afterward). Greatest perceived change and greatest attribution of change to YES! occurred with “explaining scientific concepts with everyday related examples” followed by “giving concise answers,” “asking visitors what they already know,” “linking collection objects to help visitors understand,” and “changing scientific language to everyday language.” Figure 11 details the before, now, and contribution scores, ordered by contribution scores.



* Pre-to-post differences were significant across all items

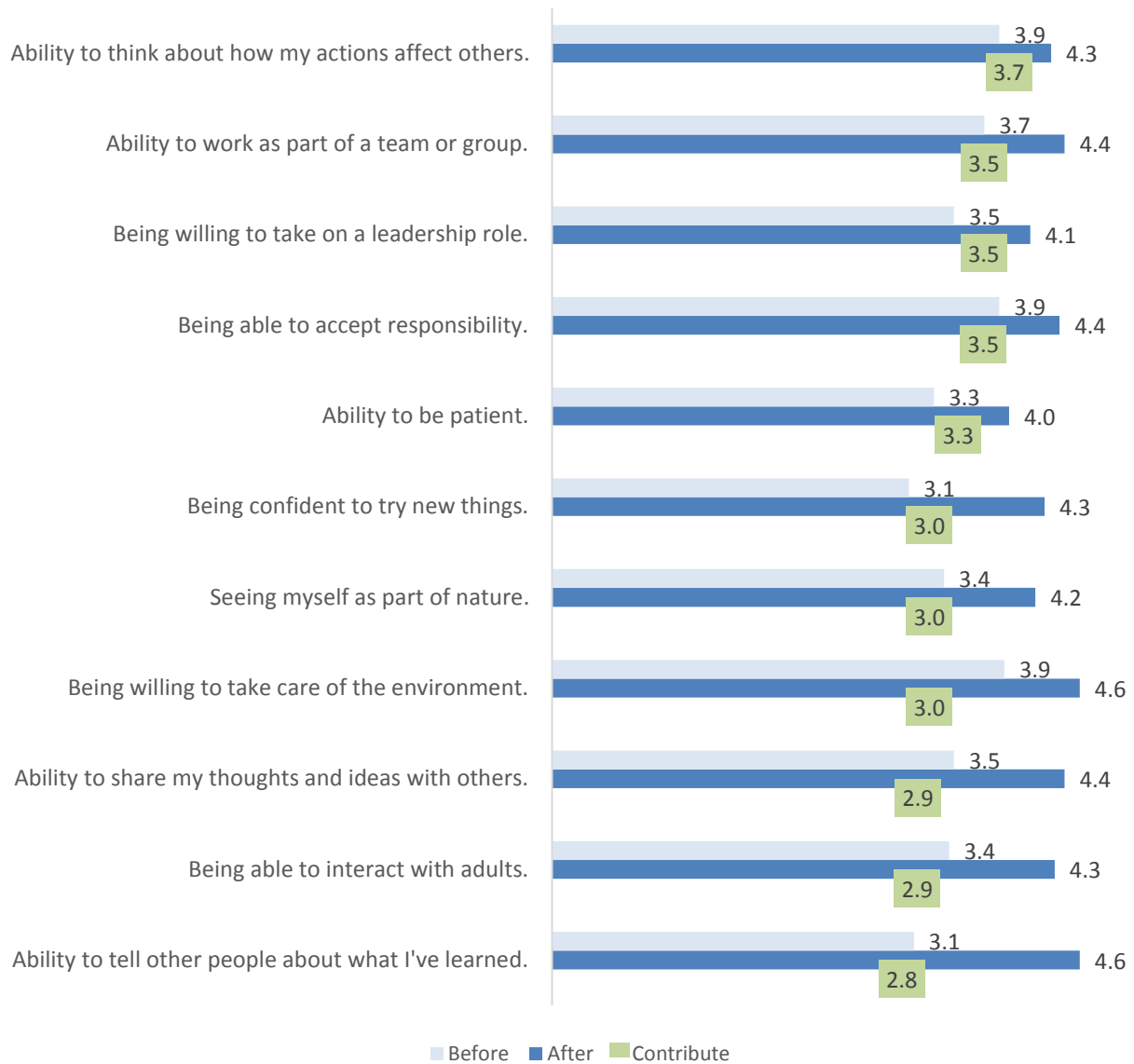
Figure 11. Teens perceived significant change in their abilities to communicate about science and largely attributed that change to YES!

21st Century Skills

Leadership Skills, Personal Identity, and Environmental Stewardship

In response to statements about the effect of YES! on leadership skills and identity, interns rated themselves as having changed significantly in their abilities from before ($M=3.5$, $sd=0.57$) to after ($M=4.3$, $sd = 0.37$) their participation ($t = 8.12$, $df=22$, $p<.001$). They rated that YES! somewhat played a role in their change. All items showed significant change from before to after. As seen in Figure 12, interns reported greatest change regarding their ability to tell other people what they've learned ($Z=-4.15$, $p<.01$). They attributed most to YES! their improved ability to think about

how their actions affect others; their ability to work as part of a team; their willingness to take on a leadership role and being able to accept responsibility.

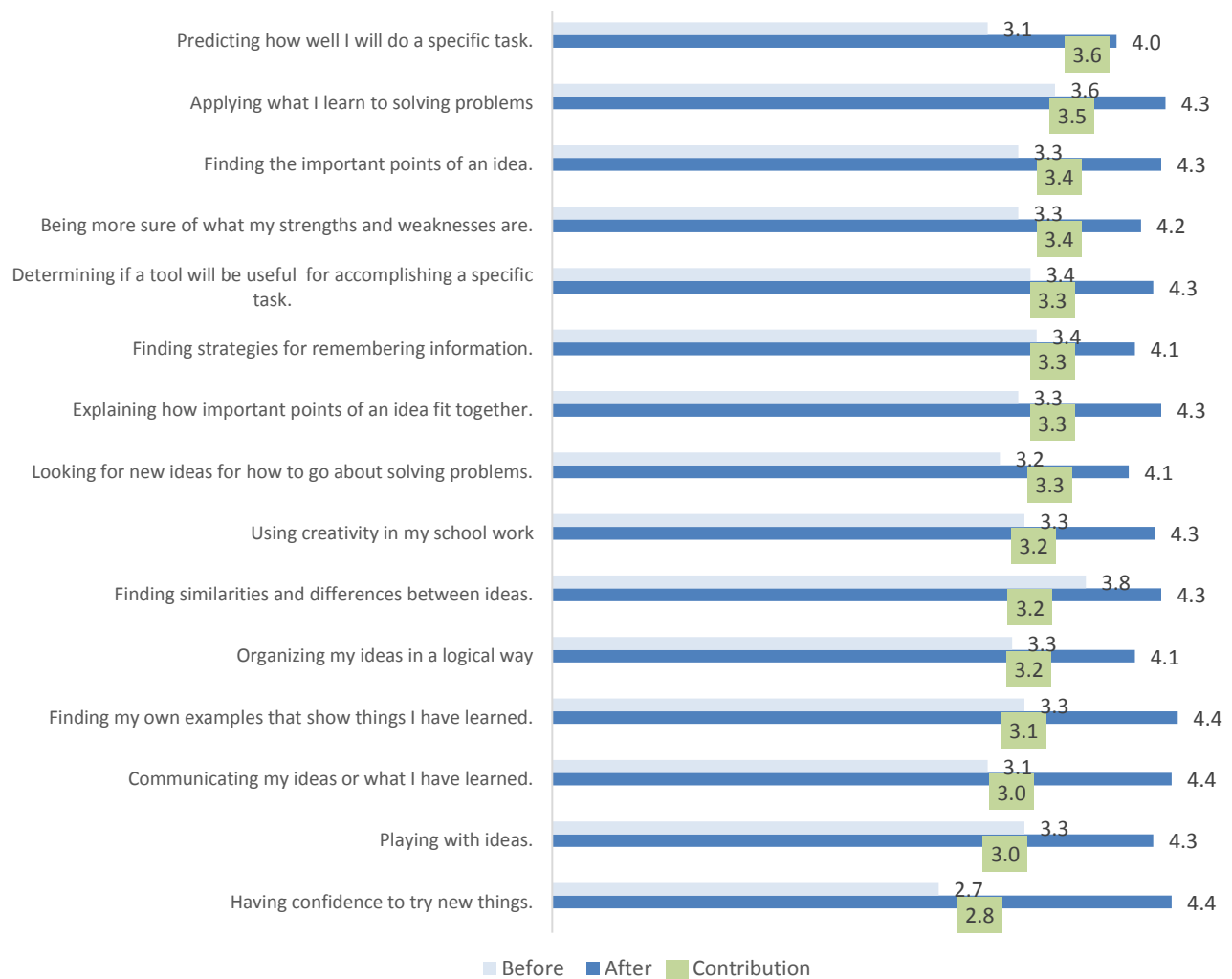


*scores are arranged by contribution score, all items are significant at the $p < .01$ level, includes the "no contribution" amounts from interns that did not change

Figure 12. Intern's perception of YES! effect on their leadership skills.

Critical Thinking

Interns reported significant growth on all items from before their participation to after their YES! Program. The reported contribution ranged from “a little” to “a lot” of the YES! Program on their feelings of change. As seen in Figure 13, the greatest change was about interns confidence to try new things ($Z=-3.84, p<.01$). Most attributed to the YES! experience was “predicting how well I will do a specific task,” and “Applying what I learn to solving problems.”



*Items are arranged by contribution scores. Note that these values include the “no contribution” amounts from even high-scoring interns who experienced no change. All items were significant at the $p<.01$ level

Figure 13. Interns reported significant change across all critical thinking items.

Creative Thinking

Both before and after their internships, YES! interns responded to items that described creative thinking at each step in the scientific process. Before the program, their ratings averaged 5.9 (agree; *s.d.* = 1.1) and on the average, remained unchanged (post-internship mean = 6.1, *s.d.* = 1.2). Per item detail are illustrated in Figure 14. There were no significant changes from pre to post by item.

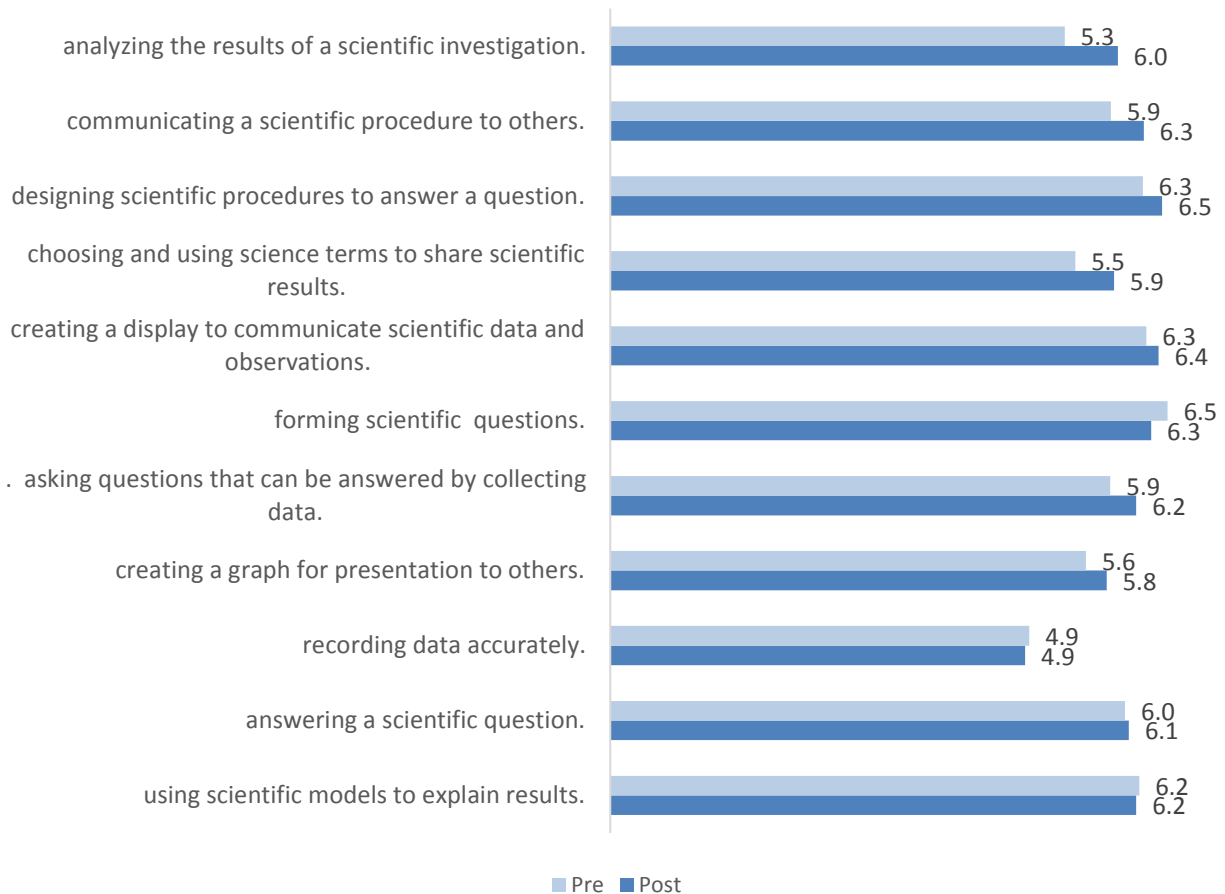


Figure 14. Per item pre to post YES! internship changes in thinking creatively (arranged by chance of pre to post difference)

Q1b. Q?Crew Results

What we Learned about Q?Crew Effects on Intended Outcomes

Program activities. Of all the Q?Crew activities, interacting with museum staff contributed most to volunteers' positive outcomes. On the other hand, discussion group participants

believed captains were equally as helpful as staff. Of note was that neither volunteer enrichment sessions nor peer relationships were seen as contributing to outcomes achieved. Pulse checks were viewed as opportunity for staff learning rather than volunteer enhancement.

Recommendation #1. Consider providing specific and useful feedback to make pulse checks a learning opportunity for volunteers.

Recommendation #2. Consider encouraging and perhaps formalizing more peer to peer facilitation, learning, and sharing of skills.

Motivational Quality.

It brings a big feeling of WOW! I'm really helping out. It increases my self-confidence a lot. My ideas were an important contribution. I belonged. I'm part of something bigger – the Smithsonian.

In line with a program that successfully motivates youth development, satisfaction of volunteers' basic psychological needs for sense of competence, relatedness, and autonomy were high and frustration of those needs were low. Over the past three years volunteers' continually improved basic psychological need satisfaction reflect continually more internalized motivation and consequently, that program outcomes will be enduring and lead to participant well-being .

Discussion group explanation for continuing need satisfaction improvements involved better, more mentor-like, relationships with Captains; improved relationships with YES! interns; and [the Youth Volunteer Coordinator]. Experiences of sense of competence emerged from working with adult volunteers and with challenging opportunities like being alone with a demonstration cart. Peer relationships functioned to enhance the experience but could be distracting.

Recommendation#1. Continue to support peer mentorship opportunities with Captains

Recommendation #2. Consider finding and formalizing complementary roles for peers working together to enhance visitor and volunteer experience.

Interest in Science. The Q?Crew experience functioned in conjunction with other extra-program influences (e.g. school, family, etc.) to contribute to volunteers' perceived significant increase in science interest. Changes occurred primarily in the areas of in "getting a job related to science" and feeling that "I will have a successful professional career and make significant contributions to science."

Science Identity. Most volunteers entered the experience highly science-identified. There was very little evidence that Q?Crew affected that identity. Across the group, elf-reported science identity changed somewhat in both directions.

Academic and Career Intention. Q?Crew appeared to have moderate effect on academic and career choice. Most responding volunteers' career choices remained the same after their Q?Crew experience as before. Almost half reported high effect on their academic choices and of that group, most intended to study a natural science with the remaining intending to study a social science.

Science Communication. Volunteers perceived themselves as significantly improving their science communication skills and largely attributed that change to Q?Crew. For these volunteers, science communication was seen as a vehicle for two-way discovery, encouraging others, and creative thinking. Volunteers generally rated themselves as between “weak” and “Just ok” before their volunteer experience to between almost “strong” and “very strong” afterward.

I was trying to figure out, what should I do? [Her companion explained] “my friend can’t see.”So instead, we went ... the most touchable stuff. Like fossils ... And I took her to the cultural anthropology section [where there’s a lot to touch] and showed her an abacus. She had fun playing with that. She taught me about using an abacus. Because that’s how she’s learned arithmetic. Then she could also touch toys and dolls. [That experience was] so unique. I will never forget that. (from a participant in the Q?Crew feedback discussion group.)

Science Content. Q?Crew volunteers’ content learning most frequently involved specific facts or topic areas. Content learning also included but less frequently, science communication, career opportunity, research processes, environment, and museology. This less-frequent type of learning was not insignificant. For example:

I discovered the field of physical anthropology over the summer, and I learned much about the kinds of research occurring with the museum specimens. Through the exposure that Q?Crew provides, I was able to get in contact with Kari Bruwelheide and gain insight on how the museum’s bone collections can help answer historical questions and contribute to our understanding of the past. Also, it’s very mind blowing. My mind has been blown.

Feedback discussion revealed that, where it occurred, learning about Smithsonian research came primarily from talking directly with researchers are “interesting to teens” and not from the field trip experience that had been designed to introduce volunteers to the subject.

Leadership skills. Q?Crew volunteers significantly changed in their leadership abilities, though overall this change was only “a little” attributed to Q?Crew. This change could then be due to external factors facing the volunteers.

Critical Thinking. Volunteers report significant change across the critical thinking skills. This change was “a lot” in part to their time with Q?Crew.

Creative Thinking. There were no significant changes found in how volunteer perceived the role of creative thinking in science.

Q?Crew - How we Know

Volunteers' Experience of the Internship's

Outcome effects described in this report first need to be understood in the context of how program participants, i.e. the interns, experienced the program. For that reason in this section we provide descriptions of how interns experienced the both the balance of program activities and the program's motivational quality.

How the Activities Balanced to Support Outcomes

Averaged responses to the question about how Q?Crew activities contributed to outcomes achieved showed that interacting with museum staff comprised almost a third of the impact. Most other programming efforts— interacting with adult volunteers; interacting with museum guests; interaction with Q?Crew Captains, tours and field trips, personal experience with museum exhibits, and boot camp week each comprised ten between eight and thirteen percent. Two areas—pulse checks and interaction with other volunteers—together contributed only nine percent.

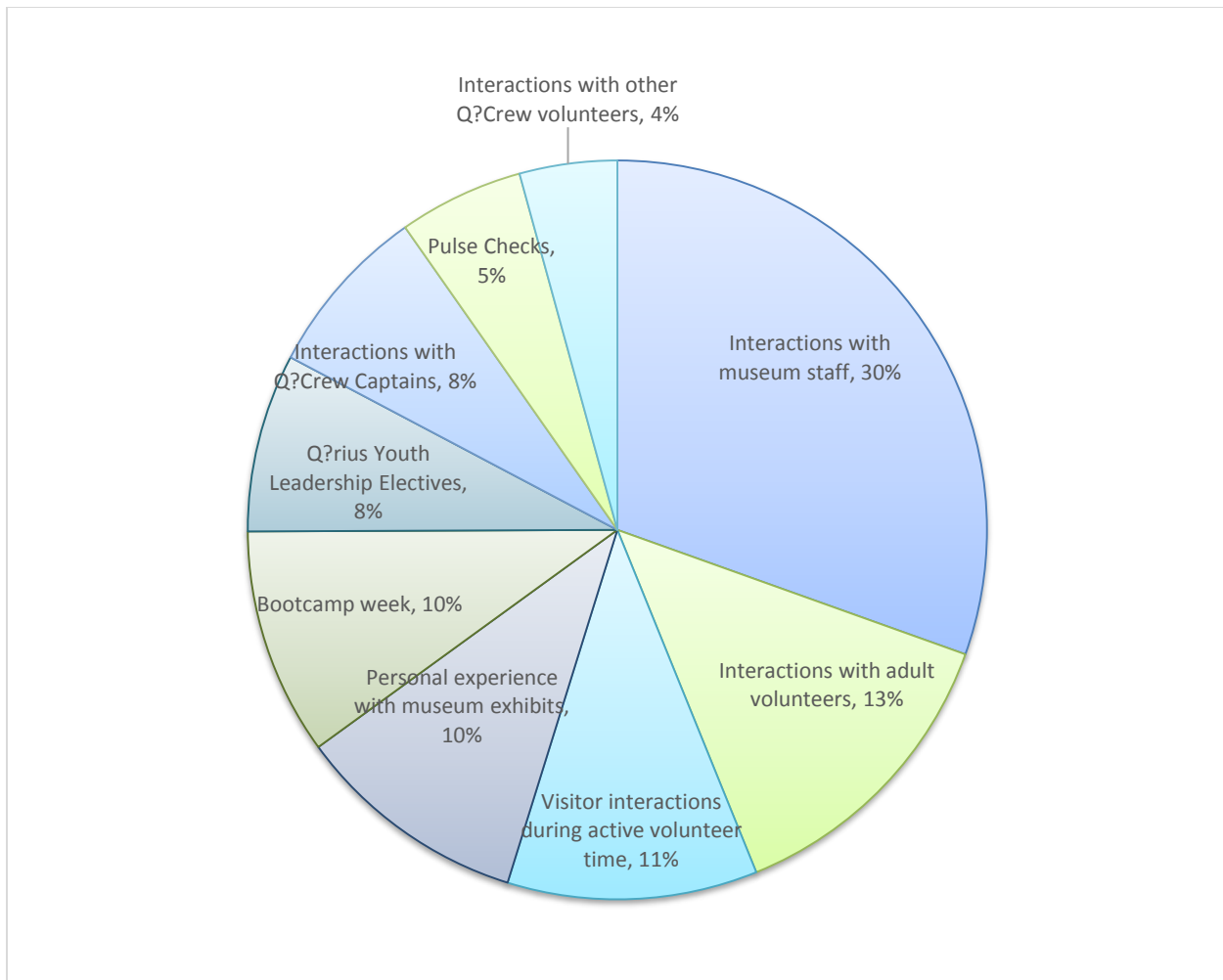


Figure 15. Distribution of how Q?Crew volunteers perceived Q?Crew activities as having contributed to the outcomes they achieved.

To provide richer understanding of this imbalance, feedback discussion groups responded to the question, What would need to happen to make the pie pieces more equal? Discussants addressed the question first by explaining why the staff proportion was so much higher than that of captains when as seen in the following comments, captains have as much influence:

“You learn techniques from staff, captains or [the Youth Volunteer Coordinator]”

And “Any facilitation I learned were from captains”

They explained the small proportion of attribution to Captains with a hypothesis about time. By December, when volunteers were completing the post-program survey, thoughts of Captain’s

influence had receded: i.e., *the more time [goes by] the more everything (in the pie besides what's current) evens out.* Their comments supported this conclusion:

If the survey were collected earlier, the percent of captains would [be higher]."

We captains need to step up their game for next year! We'd have to stay for the whole summer. At the end, [volunteers are] not thinking about captains, because [captains are] not there—[we're] only paid for a certain number of weeks.

They also believed the timing hypothesis applied to Boot Camp and pulse checks:

Boot Camp and pulse checks would become less and less relevant [as time goes on]"

Boot camp helped but its time limited. [the longer your there, the less important boot camp becomes.]"

Discussants offered additional reasons for the smaller impact of peer volunteers, pulse checks, and captains. About Peer volunteers, one said,

Our relationships to other volunteers was about friends and talking, not learning. When bored, we'd pass the time. But I'd learn from captains and [the Youth Volunteer Coordinator].

These volunteers and captains perceived Pulse Checks as more useful to the staff than to the volunteers. These next comments were illustrative:

[I would be] learning a bit about myself, but I'm giving information to them.

It helps them more than it helps me. It's not useful to Q?Crew volunteers, as much as it's helpful to them and how they can improve the program. . . .

They never share much criticism in the pulse checks.

In sum, the discussion about the inconsistent sizes of pie chart segments led to three insights: Captains were equally as helpful to volunteers as staff; peer relationships were not seen as potential avenues for learning; and pulse checks were viewed as opportunity for staff learning rather than volunteer enhancement.

Recommendation #1. Consider providing specific and useful feedback to make pulse checks a learning opportunity for volunteers.

Recommendation #2. Consider encouraging and perhaps formalizing more peer to peer facilitation, learning, and sharing of skills.

Motivational Quality

In line with a program that successfully motivates youth development, satisfaction of the basic psychological needs for sense of competence, relatedness, and autonomy were high and frustration of those needs were low (both on a 1-5 scale). Over the past three years, as shown in Figure 16, Q?Crew volunteers have experienced continually greater satisfaction of these three needs. Basic psychological needs frustration has remained relatively stable or slightly decreased over the past three years.

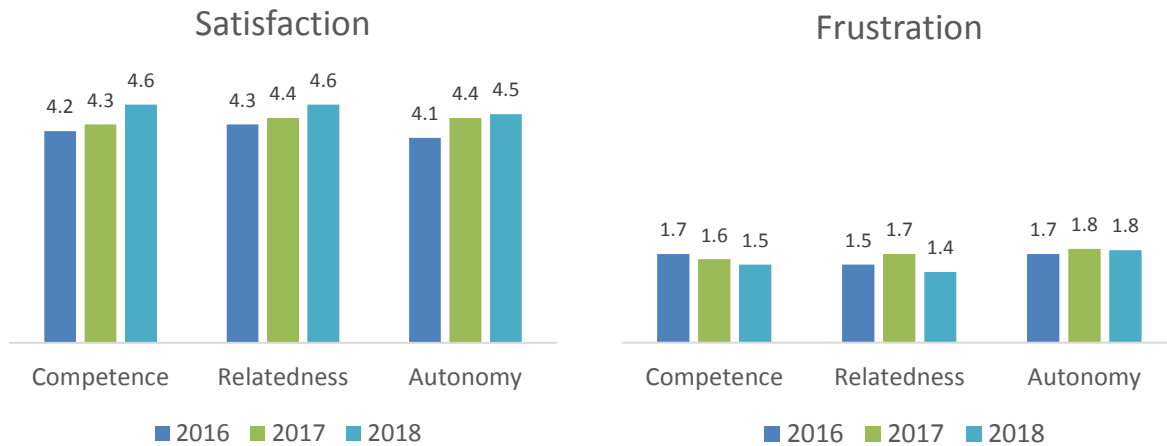


Figure 16. Q?Crew basic psychological needs satisfaction and frustration by year.

To provide richer understanding of this increasing trend in need satisfaction, feedback discussion group participants responded to the question: *What happened this year that made the Q?Crew results improve?* The discussion centered on the support volunteers experienced from Captains and staff. They also talked about experiences that satisfied each of the needs individually.

These comments about support from captains and staff highlighted not only the support received but also how that support was stronger this past year, perhaps due to strengthening the mentorship aspect of the program.

Captains were great. Well, everyone higher up. Like staff at the museum. Everyone was really nice and helpful. They're just great people to be around.

Every year, the mentorship part has grown. [This year] we saw [Youth Volunteer Coordinator] more and we saw the captains more.

I saw a familiar face every day. There were very few times I was working with someone I knew. If that happened, it was awkward. Having a captain there helped.

Captains talked to me so I wasn't nervous the first time, [reassuring me, like when they said] "You don't have to volunteer until your actual shift starts."

Captains last year weren't as nice. They left us alone with the cart [rather than assigning two people to a cart].

Another comment revealed that prior year tensions between YES! interns and Q?Crew volunteers have been resolved.

All [of us—interns and volunteers—were] even. YES! [interns] were friends who stole all your food. They were great. In electives and boot camps, you talk. Electives – you sign up because you don't know something and want to learn more. All the new kids together and the returns with the returns worked well.

On the other hand, as seen in the following comments, some discussants were ready to chalk up the improvement to one factor: [the Youth Volunteer Coordinator].

It's [the Youth Volunteer Coordinator], that's why everything's better.

And the Captains saw [Youth Volunteer Coordinator] every day.

Not to have 2 [staff people share] YES! [and Q?Crew]. Each [the Youth Internship Coordinator] and [the Youth Volunteer Coordinator] having their own program worked a lot better.

Many discussant comments (listed below) referenced sense of competence as emerging from interactions with adult volunteers; enrichment classes from “solo cart” i.e. being alone with a demonstration cart ;

[During my] first times volunteering, I talked a lot with adult volunteers. They would teach me something I hadn't learned in training. Having constant communication with people who have been here a lot [really helped]. [And I could help them too.] Like when a computer malfunctioned—I could feel smart [because I could help them fix it].

[After going to an] enrichment [classes] I came out actually knowing [about the topic], so don't have B.S.—Like the one on Forensic Anthropology. I could finally talk about the bones and know what I was talking about. I could explain more. But dealing with the practical situation--you need people who have been there. [so having the adult volunteers and captains was important].

I loved solo cart. But not at first. [an example of sense of accomplishment; a challenge met].

The nice thing about [interacting with visitors] on the cart--there's no game plan. It's nice to be able to know [the content] and say it your own way when you're solo.

I don't have to worry about talking over [the other person, when not solo] . . . Compare that [sharing the cart and saying what you want to] to being able to be alone on the cart.

On the other hand “solo cart” also took its toll the joy of volunteering and could be the cause of autonomy frustration, i.e. choice making connected with ambiguity.

[Sometimes it's] boring. You sit looking at skulls over and over. We should come up with something to do when you're solo [and the museum is slow].

Not surprisingly sense of relatedness intertwined with sense of autonomy and competence. Various comments associated relationships with making the experience enjoyable and the feeling of wanting to participate. As examples:

I like being in the collections zone; you can do your own independent thing. There's always someone there. [If there are no visitors,] then you can talk to another volunteer.

Everything in Q?rius is connected to each other and connected to the museum as a whole. You get to know other people like captains and staff.

It brings a big feeling of WOW! I'm really helping out. It increases my self-confidence a lot. My ideas were an important contribution. I belonged. I'm part of something bigger. – the Smithsonian.

On the other hand, managing peer relationships while working could present a challenge. For instance, one discussant described balancing the two:

If I'm talking to another volunteer, it's hard to separate once you start talking with them, and then go to a visitor. If there's only one or two visitors not engaging too much, [you can be] talking with other volunteers [and easily] overlook the visitor.

But underlying the specifics of the experience of the autonomy satisfying experience, discussants talked about the aura of just being in NMNH: *No other museum will be better. Even Air and Space. Why?*

[Because] Natural History covers such a broad subject, your culture, humans, mammals, evolution. Air and Space can't match it.

In sum, discussion group explanation for continuing need satisfaction improvements involved better, more mentor-like, relationships with Captains; improved relationships with YES! interns; and [the Youth Volunteer Coordinator]. Experiences of sense of competence emerged from working with adult volunteers and with challenging opportunities like being alone with a demonstration cart. Peer relationships functioned to enhance the experience but could be distracting.

Recommendation. Continue to support peer mentorship opportunities with Captains

Recommendation.. Consider finding and formalizing complementary roles for peers working together to enhance visitor and volunteer experience.

Effect on Interest in Science and Science Careers

Two areas of inquiry produced evidence of Q?Crew impact on volunteers' science-related academic and career trajectories. First was to explore changes in their interest in science and how much their Q?Crew experience contributed to that change. Second was to assess volunteers' current ideas for academic and career plans for science involvement and again, to document how much they believed their Q?Crew experience contributed to those plans.

Science Interest

Q?Crew volunteers perceived themselves as experiencing a significant increase in their interest in science. A paired-samples t-test showed a significant change in average science interest before ($M=3.78$, $sd = 0.71$) to average science interest "now" ($M=4.26$, $sd = 0.55$; $t=4.06$, $df=14$, $p=0.001$). Largest perceived change occurred with interest in "getting a job related to science" and feeling that "I will have a successful professional career and make significant contributions to science". The average attribution of change to their Q?Crew experience was 3.2, i.e. between "some" and "a lot," indicating that Q?Crew functioned in conjunction with other influences in these young peoples' lives. Per item responses, arranged in order of contribution score (from high contribution to low, are shown in Figure 17. Blue ovals indicate most significant changes.

Interpretation. The Q?Crew experience functioned in conjunction with other extra-program influences (e.g. school, family, etc.) to contribute to volunteers' science interest.

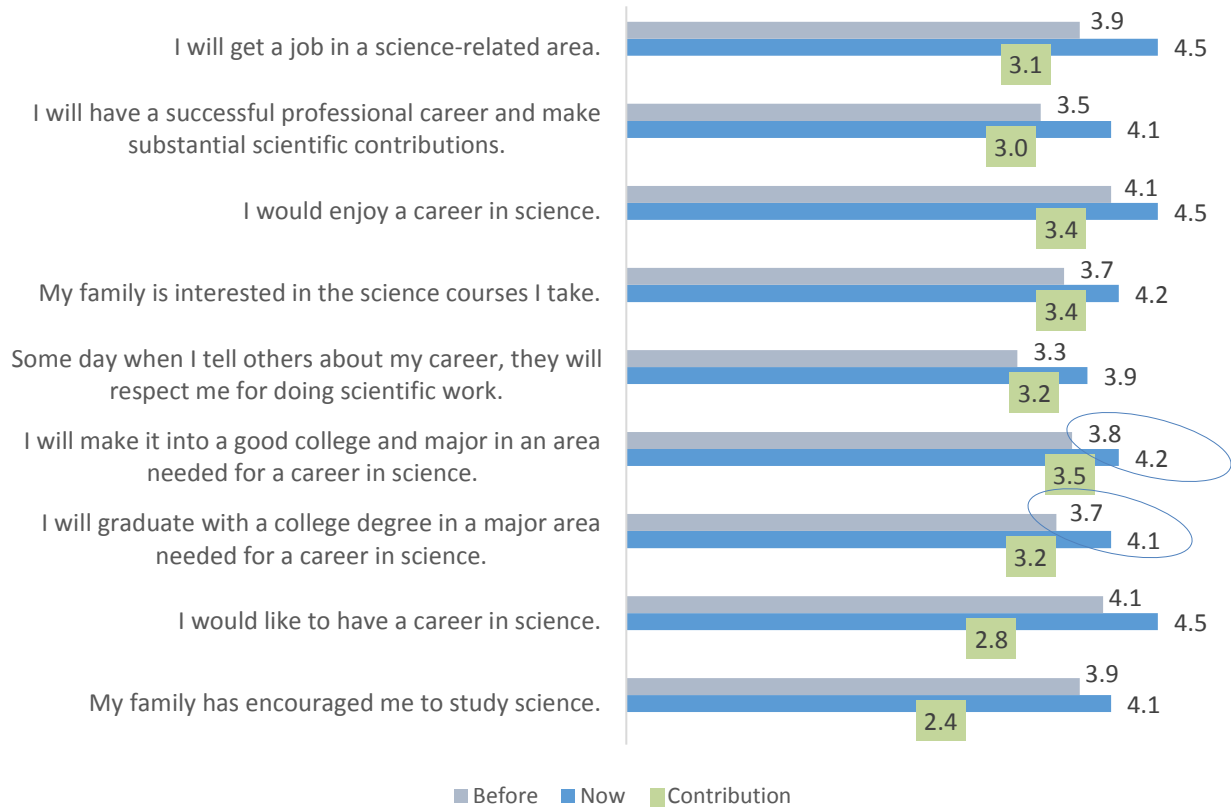


Figure 17. Before and after mean per-item science interest scores arranged in order of perceived program contribution to the difference.

Science Identity

Of the nine volunteers who responded both before their Q?Crew experience and after at least 75 house, five (45%) perceived the same level of science identity 3 (27%) became more identified and 1 less so (Figure 18).

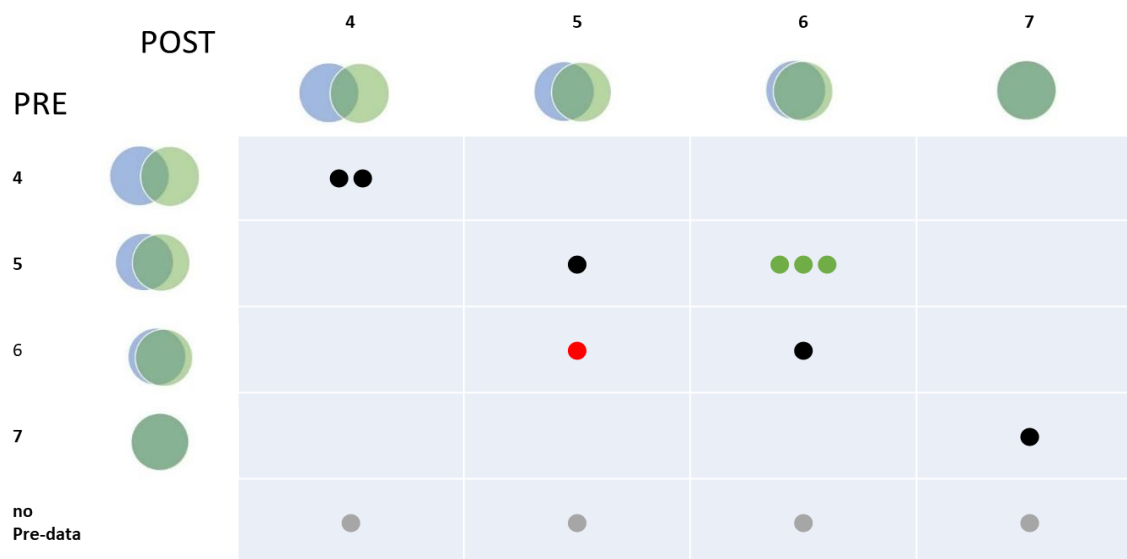


Figure 18. Comparison of Q?Crew volunteers personal identification with science from pre to post

Responses to the science identity scale provided a different view. Probably due to the small sample size any change in identity could not be detected (pre $M=7.6$, $sd=0.79$; post $M=7.9$, $sd=0.76$; $t=1.3$, $df=11$, $p=0.19$).

Among the positive items, volunteers reported the greatest agreement with being “interested in the ways science can be used to help people” and least with learning about science by talking with “others outside of school.” Among the negatively worded items, they agreed least with “scientific topics do not interest me” and most with “I do not think a lot about how my life is affected by science.” Curiously, this item was most changed among the YES! interns. Details of all items can be found in Figure 19.

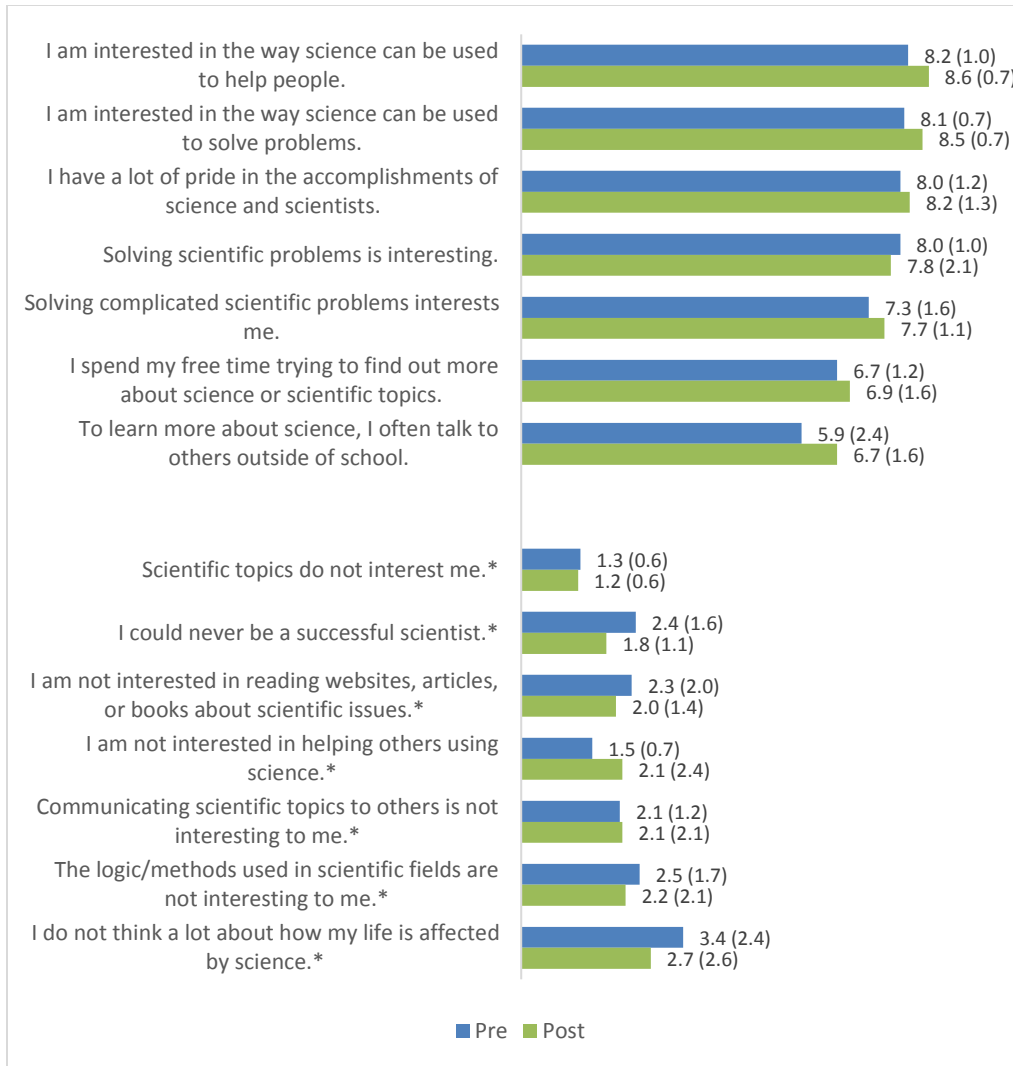


Figure 19. Q?Crew volunteer's science identity before and after participation arranged by post-test score.

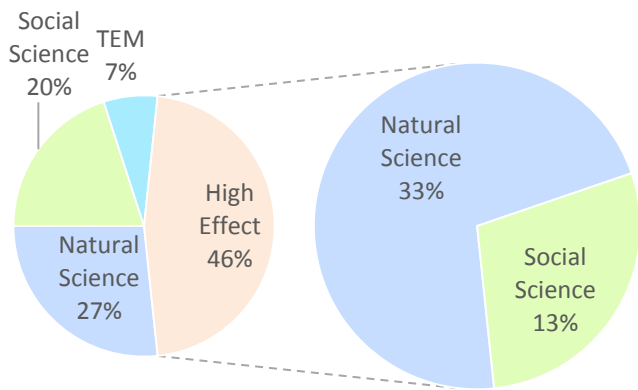
Academic and Career Intentions

As illustrated in Figure 20, about half (46%, $n=7$) of Q?Crew volunteers reported a high effect of their volunteer experience on their academic intentions. Of the volunteers who reported this high effect, about three fourths ($n=5$) were interested in natural science. The remaining fourth ($n=2$) were interested in an academic path surrounding social sciences. Half of the low-effect academic subjects ($n=4$) were Natural Science, with the other half being a majority social science ($n=3$) and one volunteer interested in technology, engineering, or math.

Most volunteers ($n=7$) reported no change in the subject of their academic intentions (Figure 22). Of those who did change, three changed laterally, meaning they changed to a different area of science related field including two changing to natural science and one to social science. Two volunteers changed from non-STE, one to natural science and the other to social science. Further detail can be found in Appendix H.

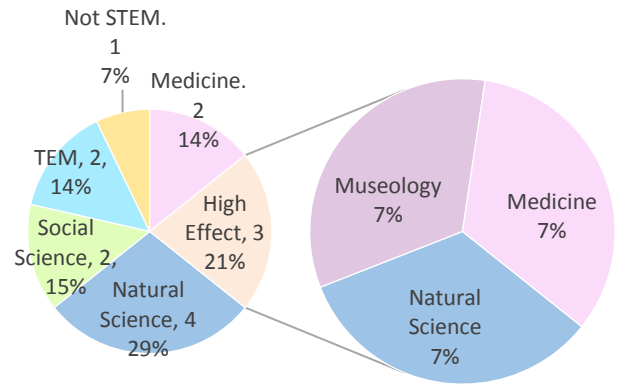
As illustrated in Figure 21, about three of the 14 respondents (21%) reported high effects of the program on their career intentions. Those three were intending careers in museology, medicine, and natural science. Those with low effect divided into groups of about a third (29%) natural science, about 15% each ($n=2$) in social science, medicine, and technology, engineering, and math. One volunteer was interested in a career unrelated to STEM.

Most respondents ($n=6$) reported no change in the subject of their career intentions (Figure 23). Of those who did change, 4 laterally to a different focus within medicine ($n=2$), museology ($n=1$), or technology, engineering, and math ($n=1$). One volunteer changed from a non-STEM career to a natural science career. More detail can be found in Appendix H.



Whole Group (N=15)
with Detail of Low Effect (N=8)

High Effect (n=7)



Whole Group (N=14)
with Detail of Low Effect (N=11)

High Effect (N=3)

Figure 20. Distribution of academic intentions for Q?Crew volunteers divided by volunteer perception of low and high effect on their intentions.

Figure 21. Distribution of career intentions for Q?Crew volunteers divided by volunteer perception of low and high effect on their intentions

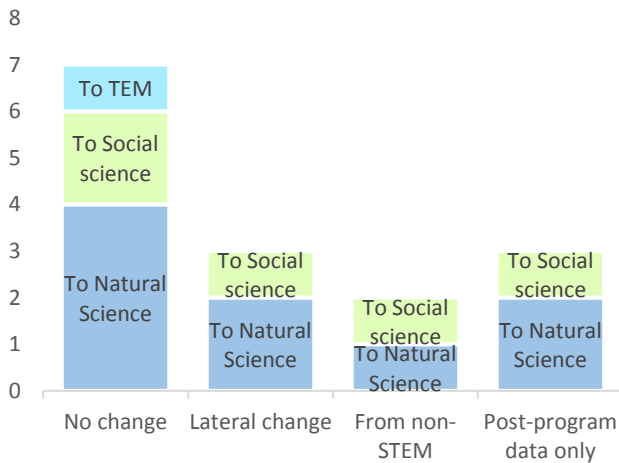


Figure 22. Changes in academic intentions for Q?Crew volunteers.

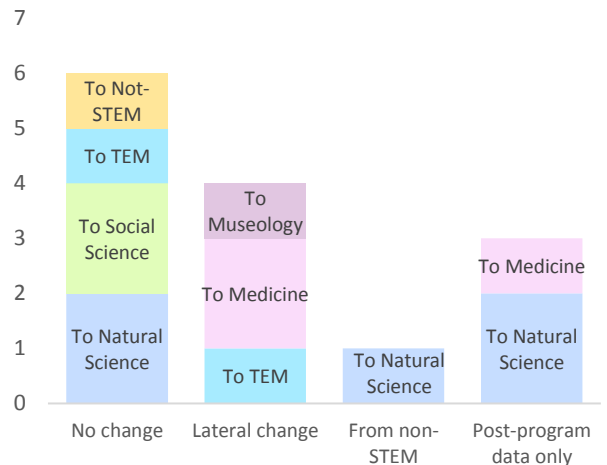


Figure 23. Changes in career intentions for Q?Crew volunteers.

Comfort with Communicating about Science

There was a little girl who was blind with her companion. She had a walking stick and was speaking Spanish. I speak Spanish. We were speaking together in Spanglish and I was trying to figure out, what should I do? [Her companion explained] "my friend can't

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NMNH

Lifelong Learning Group

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SCALE Youth Programs

see.” And [as a volunteer] you usually guide visitors to the most visually appealing experience. So instead, we went to the exhibits tagged green or yellow – the most touchable stuff. Like fossils and [rodents?] And I took her to the cultural anthropology section [where there’s a lot to touch] and showed her an abacus. She had fun playing with that. She taught me about using an abacus. Because that’s how she’s learned arithmetic. Then she could also touch toys and dolls. [That experience was] so unique. I will never forget that. (from a participant in the Q?Crew feedback discussion group.)

This quote illustrates how Q?Crew **Volunteers used science communication for encouraging others, two-way discovery, and creative thinking.** Additional feedback discussion group comments that illustrate this use of communication included:

When a visitor comes in (similar age, high school. student), and they’re definitely interested in science or they talk about a specific interest, you have a good conversation. They realize they want to become a scientist and that’s awesome.

A 13 year old came every day. He would go through all the rocks. Because of HIM, I know all the rocks. He said he wanted to be a geologist. I told him he definitely would be. [That meant a lot to him, I knew by the way he looked at me] and said “thank you.”

Data from the science communication scale provided evidence that volunteers significantly improved their science communication skills and largely attributed that change to Q?Crew.

Overall, the Q?Crew volunteers rated significant change in their science communication abilities from before participating ($M=2.29$, $sd=.45$) to after their participation ($M=4.22$, $sd=.40$; $t(13)=9.84$, $p<.01$). By item, volunteers perceived themselves as experiencing significant change, barring the item “linking multiple maps, graphs, charts, or tables with each other to help visitors understand my explanation” which did not change significantly. Volunteers generally rated themselves as between “weak” and “Just ok” before the program to between almost “strong” and “very strong” afterward (Figure 24). They attributed these changes largely to their Q?Crew experience (green labels in the figure) , with the items “using questions to help visitors discover things” and “explaining scientific concepts with everyday related examples” receiving highest attribution.

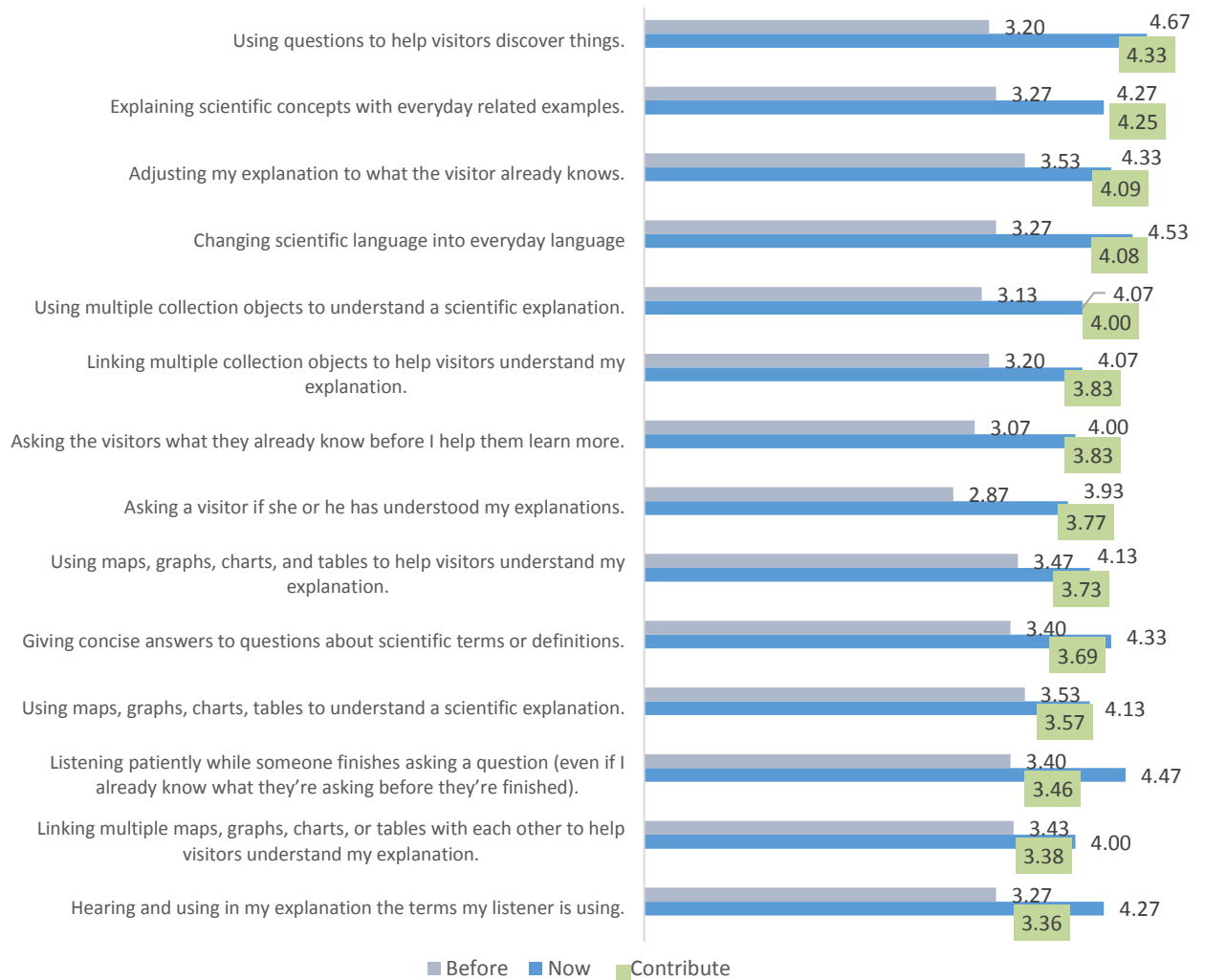


Figure 24. Teens reported high moderate to high Q?Crew contribution to their significant changes in Science Communication.

Specific Skills: Science Content

As seen in Figure 25, Q?Crew volunteers’ science content learning primarily could be categorized as facts or specific topic areas (i.e. forensic anthropology, human evolution). Remaining learning content sprinkled pretty evenly between communicating with visitors or communicating their knowledge to others; knowing more about what happens “behind-the-scenes” at museums or how artifacts can work aesthetically; the environment; future career opportunity; and science research processes.

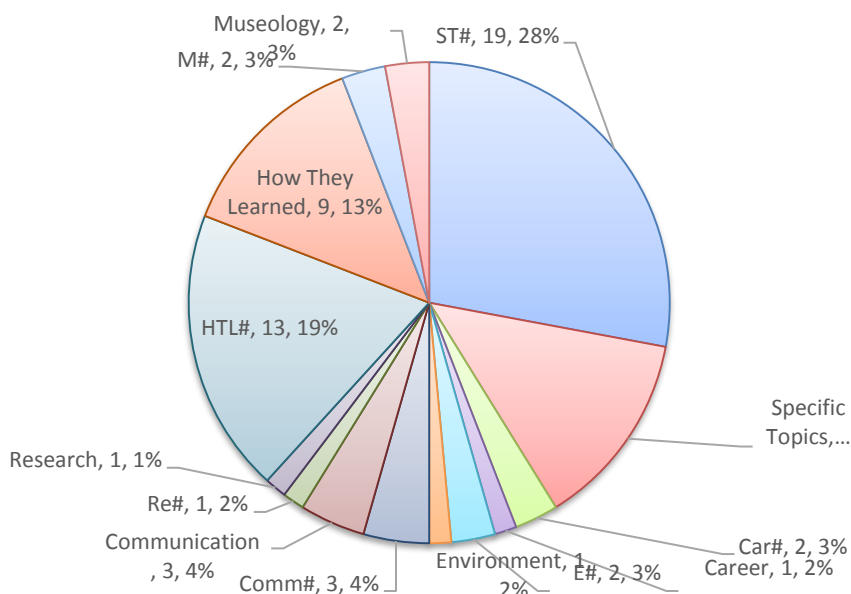


Figure 25. Distribution of content categories.

Despite the preponderance of specific facts demanded by the nature of working in the Q?rius exhibition space, volunteers’ learning outside of those specifics could be profound as was illustrated in this “specific content” explanation:

I discovered the field of physical anthropology over the summer, and I learned much about the kinds of research occurring with the museum specimens. Through the exposure that Q?Crew provides, I was able to get in contact with Kari Bruwelheide and gain insight on how the museum's bone collections can help answer historical questions and contribute to our understanding of the past. Also, it's very mind blowing. My mind has been blown.

One Q?Crew activity, the field trip to Smithsonian Environmental Research Center (SERC), had been designed to help promote Q?Crew volunteers’ understanding of Smithsonian and research processes. Concerned about the effectiveness of the event and wanting to know more about how it was perceived, staff asked that feedback discussion group participants respond to the following question:

Please talk about what you know of what the Smithsonian researchers do and how you've come to know that? How much did you learn from the bio cube immersive field trip experience at SERC (Smithsonian Environmental Research Center) and the half-day preparation for it? What was the benefit? What would make it worth doing again next year? In what ways did it help your ability to talk with visitors about Smithsonian research?

Staff were right to question the effectiveness of the event. The discussion began with the comment, "We know more than before, but basically, not at all." According to these discussants, the Q?Crew volunteers and captains weren't even aware of the field trip's research objective. Instead, as revealed by the following comments, they believed the objective was to have a team building experience and learn about the topic of biodiversity

[The SERC field trip] was to learn about biodiversity, not research. It was more as a bonding retreat. I suppose I could understand how it was about the researchers, but not really.

There was a presentation room and microscopes – I learned from the presentation -- about biodiversity. And about the website about biodiversity.

It really served to learn from each other about why people came to the program; [it was like a] corporate bonding retreat.

[I thought the purpose was] to learn about bio diversity. [Last year,] my bus broke down, then it was really fun because we learned about each other.

It may have been about the scientific memory or something, but that's not what I remember.

A couple of researchers there at SERC, but the people who went with us were staff.

Discussants also offered the following comments about what *did* work to help volunteers learn about research.

I learned about the researchers from the presentations they gave.

[I learned about the Smithsonian researchers through] a post-doc fellow named Bart. Not only why he does research but also [I learned about] the scientific cycle – in his own experience. He talked about major research projects in Australia.

[it helps most to] talk to researchers about their work

Find someone interesting in the eyes of teens.

21st Century Skills

Leadership Skills

In response to statements about the effect of Q?Crew on leadership skills and identity, volunteers rated themselves as having significantly changed in their abilities from before ($M=3.7, sd=.35$) to after ($M=4.4, sd=.26; t(14)=10.23, p<.01$) their participation. They rated that Q?Crew somewhat played a role in their change ($M=3.37$; between “somewhat” and “a lot”). Significant pre-to-post-program change occurred across many as seen in Figure 27 with pre-program agreement being between “ok” to “strong” and after the program feeling between “strong” and “very strong”.

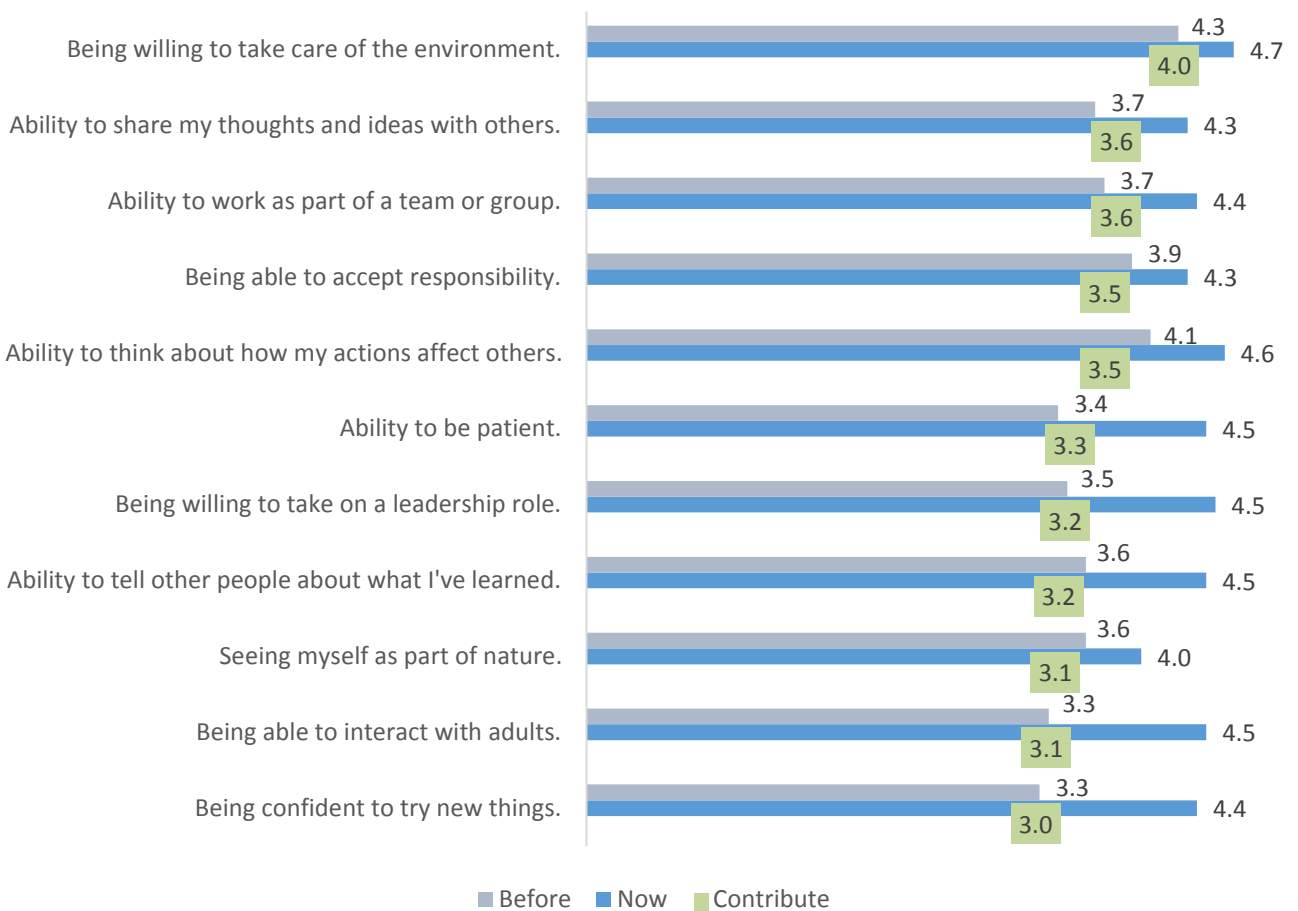


Figure 26. Volunteer perception of Q?Crew effect on their identity and leadership skills.

Critical Thinking

Volunteers perceived themselves as having significantly improved their critical thinking skills (pre-Q?Crew $M=3.56$, $sd=.45$; after at least 75 hours $M=4.32$, $sd=.44$; $t=9.75$, $df=14$, $p<.01$). Items constituting the critical thinking scale are listed in (Figure 27 Figure 26) in order the average amount respondents attributed the change to their Q?Crew experience. The reported contribution ranged from “a little” to “a lot”, with most contribution to “finding similarities and differences between ideas;” “Finding strategies for remembering information;” and “Looking for new ideas for how to go about solving problems.” Volunteers assigned least attribution to “playing with ideas” and “using creativity in my school work.” Across all items, average attribution to Q?Crew was 3.4 ($sd=.60$), between “somewhat” and “a lot.”

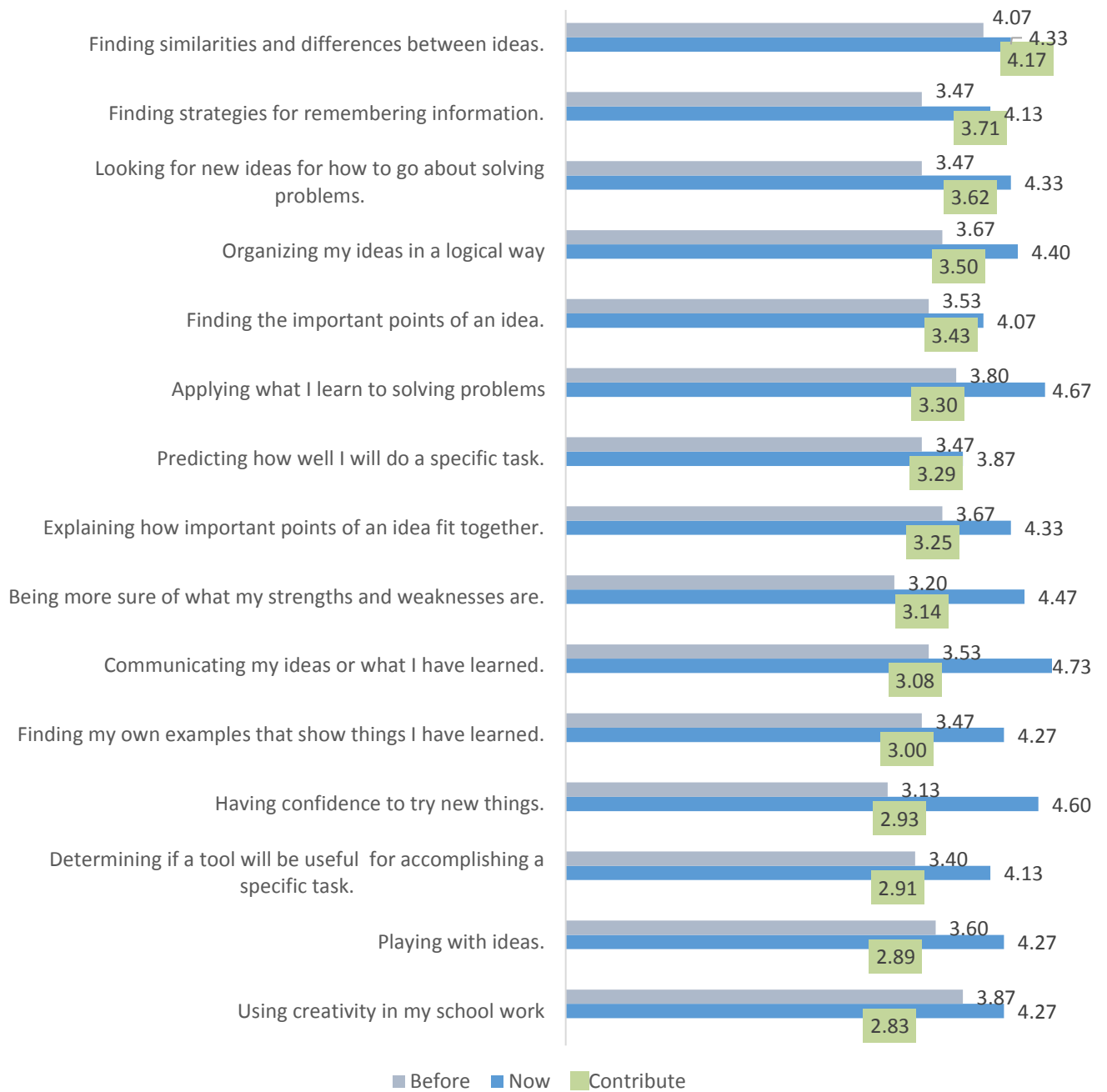


Figure 27. Q?Crew volunteers reported significant change across all critical thinking items, items are arranged by contribution scores, circled items are significant changes pre to post.

Creative Thinking

Q?Crew volunteers responses to the creative thinking in science scale did not change significantly from their responses prior to Q?Crew and after at least 75 hours. Nor were there any significant changes by item..

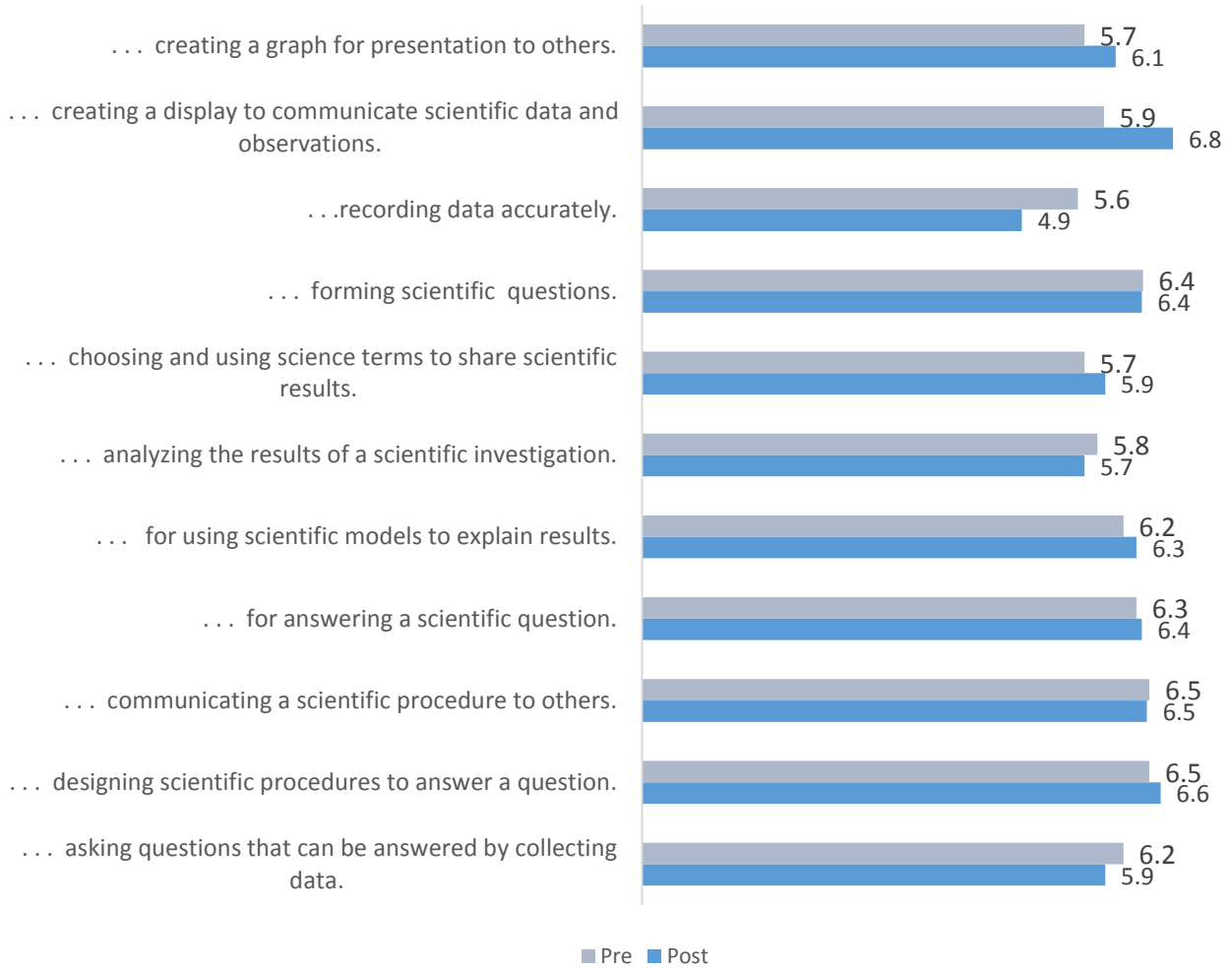


Figure 28. Per item changes in thinking creatively from prior to starting Q?Crew to after participation.

Q1c. Q?Crew Captain Results

What we learned about the Q?Crew Captains Internship Effect on Intended Outcomes

Program activities. Q?Crew Captains drew value almost equally from all aspects of the Q?Crew experience except pulse checks and interactions with adult staff.

Motivational Quality. In line with programs that successfully motivate youth development, satisfaction of captains' basic psychological needs for sense of competence, relatedness, and autonomy were high and frustration of those needs were low.

Interest in Science. Captains did not have significantly more interested in studying, pursuing, and enjoying science. The least amount of attribution to Q?Crew participation were family related. Other items related to jobs or careers were contributed somewhat to their participation. This could indicate that captains, having already participated in Q?Crew before, found influences for their science careers and academics elsewhere.

Academic and Career Intentions. Most captains had academic and career aspirations that were natural science related. All reported low effects of their Q?Crew captain experience on their aspirations.

Science Communication. Captains perceived themselves as having improved their communication skills and attributed that change between "somewhat" and "a lot" to their Q?Crew Captain experience.

Science Content. Most captains listed learning related to specific fields, primarily within paleontology and forensic ornithology. Second most frequently, they listed communication skills (including mentoring and leadership). Research processes and understanding scientific methods; career exploration; and museology (collections management) were also areas of specific content learning. Learning occurred across these areas as shown in this comment:

The learning that I did with bird lab and the forensic ornithology team gave me the most content. Learning about the processes that they use to ID birds, the various levels of microscopy, microstructures, and pigmentation and the use of this element in the feather was really insightful. This was also a window into how research in ornithology is done and [how] the steps in the ID process [are] done.

Leadership skills. Captains perceived a high program effect on their feelings of confidence to try new things, abilities to work as part of a team, and to share their thoughts or ideas with others.

Critical Thinking. No significant changes were reported and the captains reported that Q?Crew did not have a large effect on their critical thinking skills. This could indicate that captains, since

they had already participated in the program, Q?Crew didn't have as much of an effect on critical thinking skills.

Creative Thinking. Over the course of the summer Q?Crew captains discovered room for more creativity in the science process areas of “analyzing results of a scientific investigation; creating a graph for presentation to others; and asking questions that can be answered by collecting data.

Q?Crew Captains - How we Know

The five Q?Crew Captains completed the Q?Crew questionnaire at the completion of their summer internship which involved providing leadership to summer Q?Crew volunteers. Although responses from such a small number of people is not enough for statistical analysis, we provide here descriptions of their responses.

Captains' Experience of the Internship

How Q?Crew Activities Supported Captains' Outcomes

Q?Crew Captains drew value almost equally from all aspects of the Q?Crew experience except pulse checks and interactions with adult staff. Also of relatively less value were Boot Camp week and Leadership electives. Figure 29 illustrates the distribution.

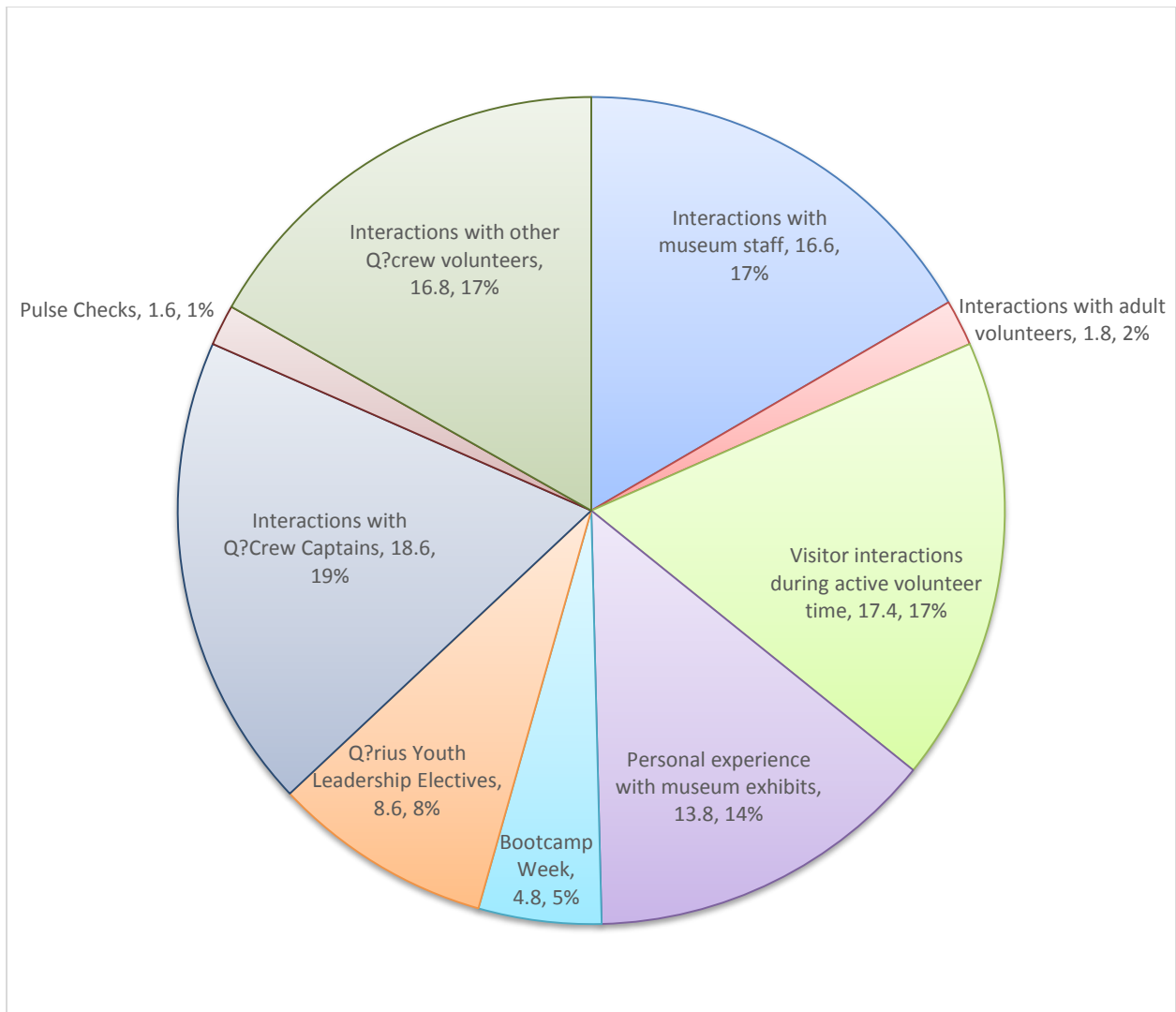


Figure 29. Distribution of how Q?Crew Captains perceived Q?Crew activities as having contributed to the outcomes they achieved.

Captains' Experience of Internship's Motivational Quality

As seen in Figure 30, Q?Crew volunteers have experienced high feelings of autonomy and competence, with relatedness being not far behind. In regards to frustration all three categories are not disparate from each other, with feelings of frustration regarding competence being only slightly higher than relatedness or autonomy.

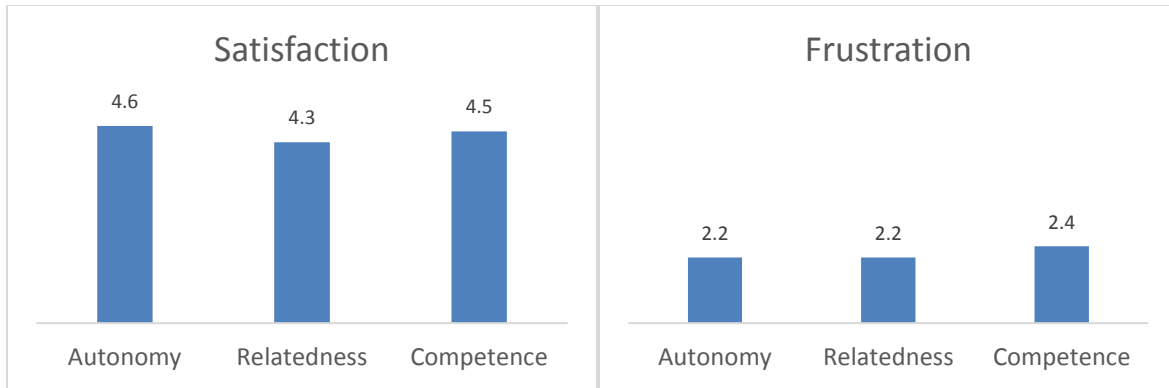


Figure 30. Q?Crew Captains' 2018 basic psychological needs satisfaction and frustration.

Effect on Interest in Science and Science Careers

Two areas of inquiry addressed the question of the impact of Q?Crew captain program on teens' science-related academic and career trajectories. First was to explore changes in their interest in science and how much their Q?Crew captain experience contributed to that change. Second was to assess captains' current ideas for academic and career plans for science involvement and again, to document how much they believed their Q?Crew captain experience contributed to those plans.

Effect on Science Interest

Results (Figure 31) revealed that Q?Crew Captains did not perceived themselves as experiencing a significant change in their interest in science. The average attribution of change after their Q?Crew Captain experience was 2.6, indicating that being a Q?Crew captain contributed between "a little" and "some" to extra-program influences that affected this change. Per item responses, arranged in order of contribution score (from high contribution to low), are shown in Figure 31.

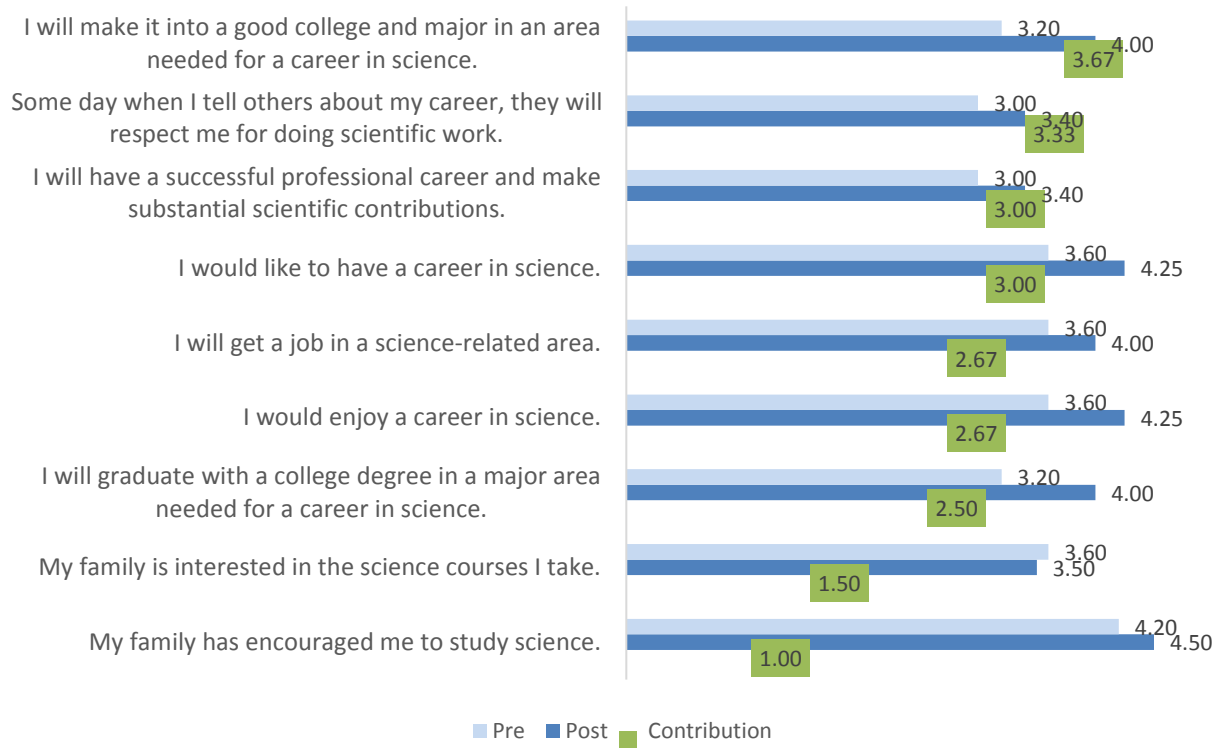


Figure 31. Before and after mean per-item science interest scores arranged in order of perceived program contribution to the difference.

Effect on Science Identity

From before to after the summer experience, three of the five Captains remained the same regarding their science identity. The remaining two captains perceived themselves as less science identified. Data from the science identity scale was unavailable for this group.

Effect on Academic and Career Intentions

As illustrated in Figure 32, all Q?Crew captains reported a low effect of their captain experience on their academic intentions. About 80% of the captains ($n=4$) had already been interested in studying natural science, with the other being interested in a non-STEM academic subject.

Most captains ($n=3$) reported no change in the subject of their academic intentions. Of those who did change, one changed laterally, moving to natural science from social science. One captain changed to a non-STEM related academic choice from a social science choice, as seen in Figure 32.

As illustrated in Figure 33, just under half ($n=2$, 40%) of participants selected careers either in natural science fields or not related to STEM. The other captain was interested in a career in medicine. Most captains ($n=4$) reported no change in the subject of their career intentions. The one captain who did change, changed laterally to natural science from a TEM (technology, engineering, and math) career.

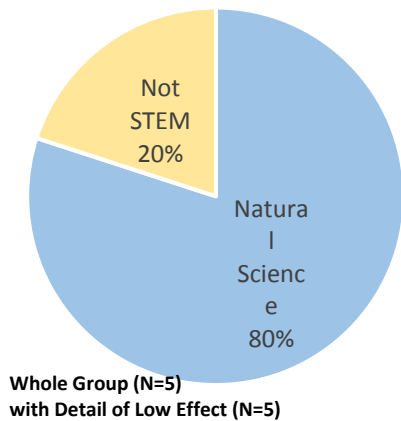


Figure 32. Distribution of academic intentions for Q?Crew captains, all with low effect.

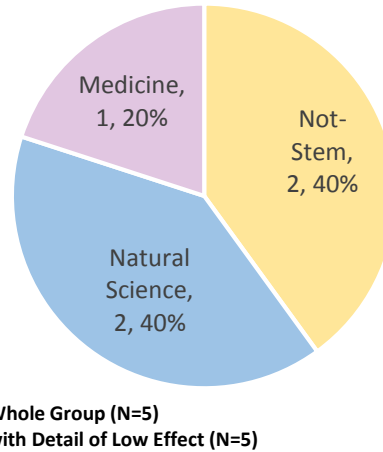


Figure 33. Distribution of career intentions for Q?Crew captains, all low effect.

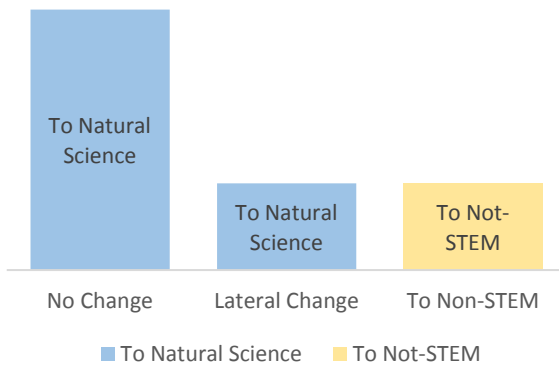


Figure 34. Changes in academic intentions for Q?Crew captains.

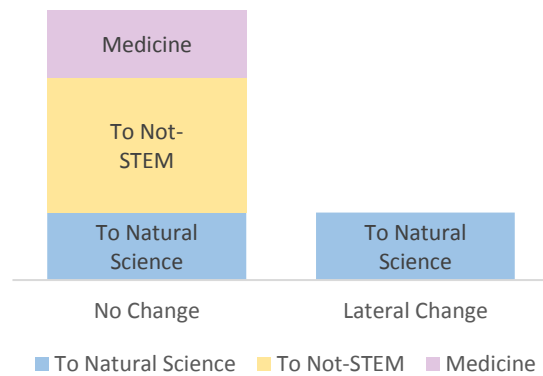


Figure 35. Changes in career intentions for Q?Crew captains.

Comfort with Communicating about Science

Captains perceived themselves as having improved their communication skills and attributed that change between “somewhat” and “a lot” ($M=3.3$) to their Q?Crew Captain experience. Of the items listed in Figure 36 They attributed to Q?Crew most highly (“a lot”) their improved abilities to use COSI Center for Research and Evaluation

NMNH

“multiple collection objects to understand a scientific explanation” and “linking multiple collection objects to help visitors understand my explanation.” They experienced greatest change in the areas of “ask a visitor if they had understood their explanations” and “using multiple collection objects to understand a scientific explanation.”

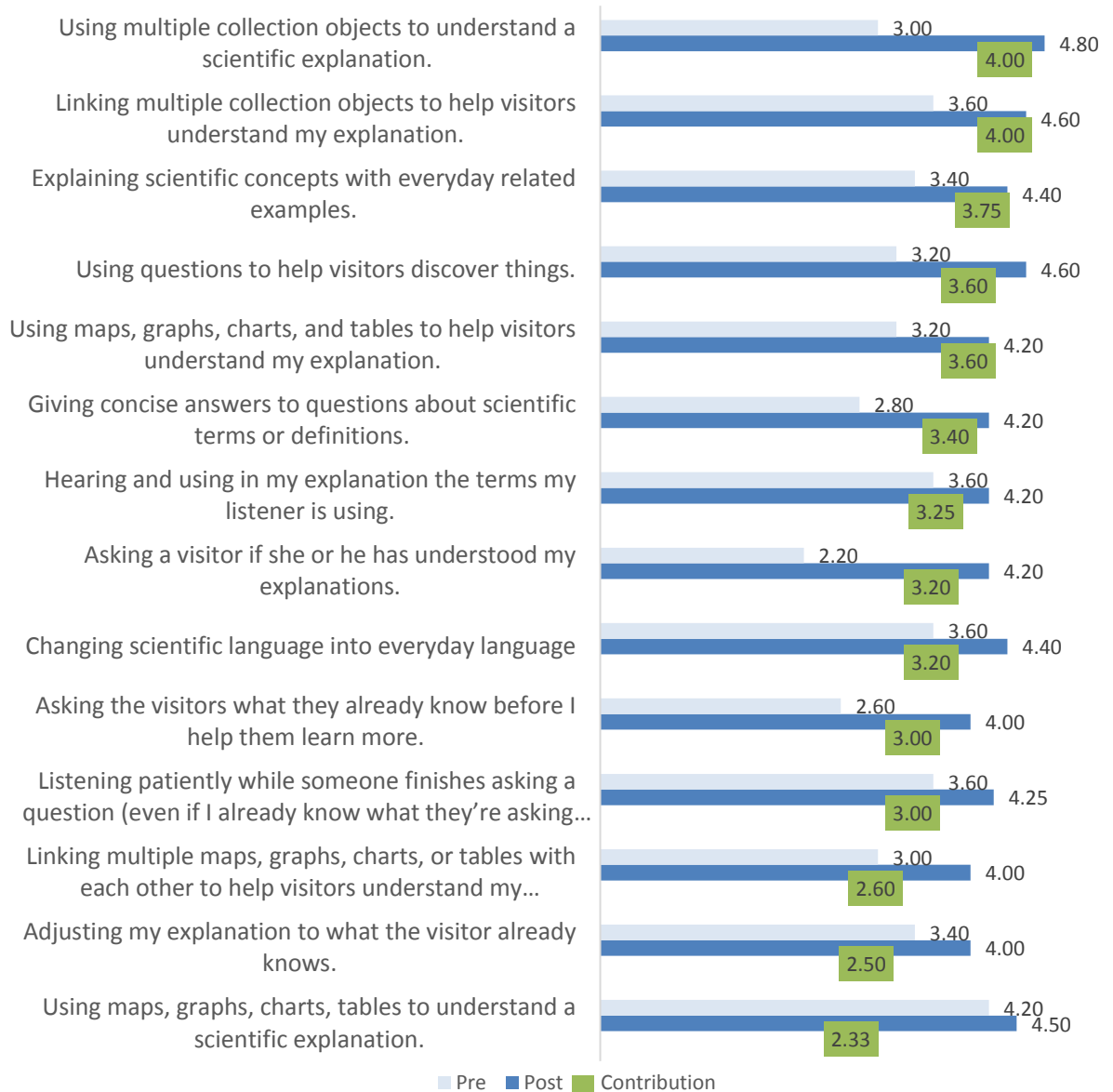


Figure 36. Captains perceived increased Science Communication skills and attributed them between “a bit” and “a lot” to their Q?Crew experience.

Specific Skills: Science Content

As seen in Figure 37, Most captains listed learning related to specific fields, primarily within paleontology and forensic ornithology. Second most frequently, they listed communication skills (including mentoring and leadership). Examples of these comments demonstrated a wide range of communication application such as in these following comments:

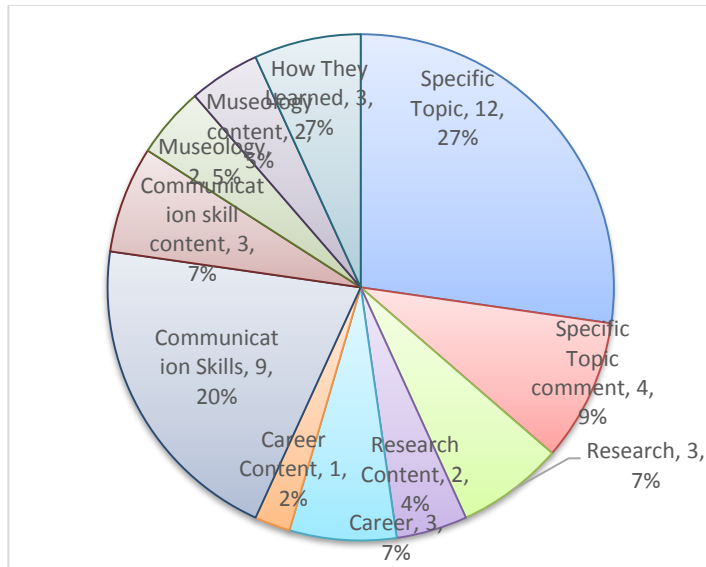


Figure 37. Distribution of content categories.

Working at Q?rius helped me learn how to collaborate with others...";

"I've made the new volunteers feel comfortable interacting [with] the visitors by demonstrating how to interact with visitors..."

Specific content ranged from the simple to more in-depth and research-related as in this comment:

The learning that I did with bird lab and the forensic ornithology team gave me the most content. Learning about

the processes that they use to ID birds, the various levels of microscopy, microstructures, and pigmentation and the use of this element in the feather was really insightful. This was also a window into how research in ornithology is done and the steps in the ID process is done.

21st Century Skills: Leadership and Identity; Critical thinking; Creative Thinking

Leadership skills

Captains reported that the program had a high effect on their leadership abilities. This was especially true for their feelings of confidence to try new things, to work as part of a team or group, and to share their thoughts or ideas with others. Average responses can be seen in Figure 38.



Figure 38. Captain' average agreement with how much the internship contributed to leadership capabilities, (post-program only).

Critical Thinking

Overall, captains perceived themselves as having gained in most all critical thinking skills (Figure 39). In general, they reported that their Q?Crew internship had “a little” or “some” effect on these changes, but “a lot” of effect on their “confidence to try new things.”

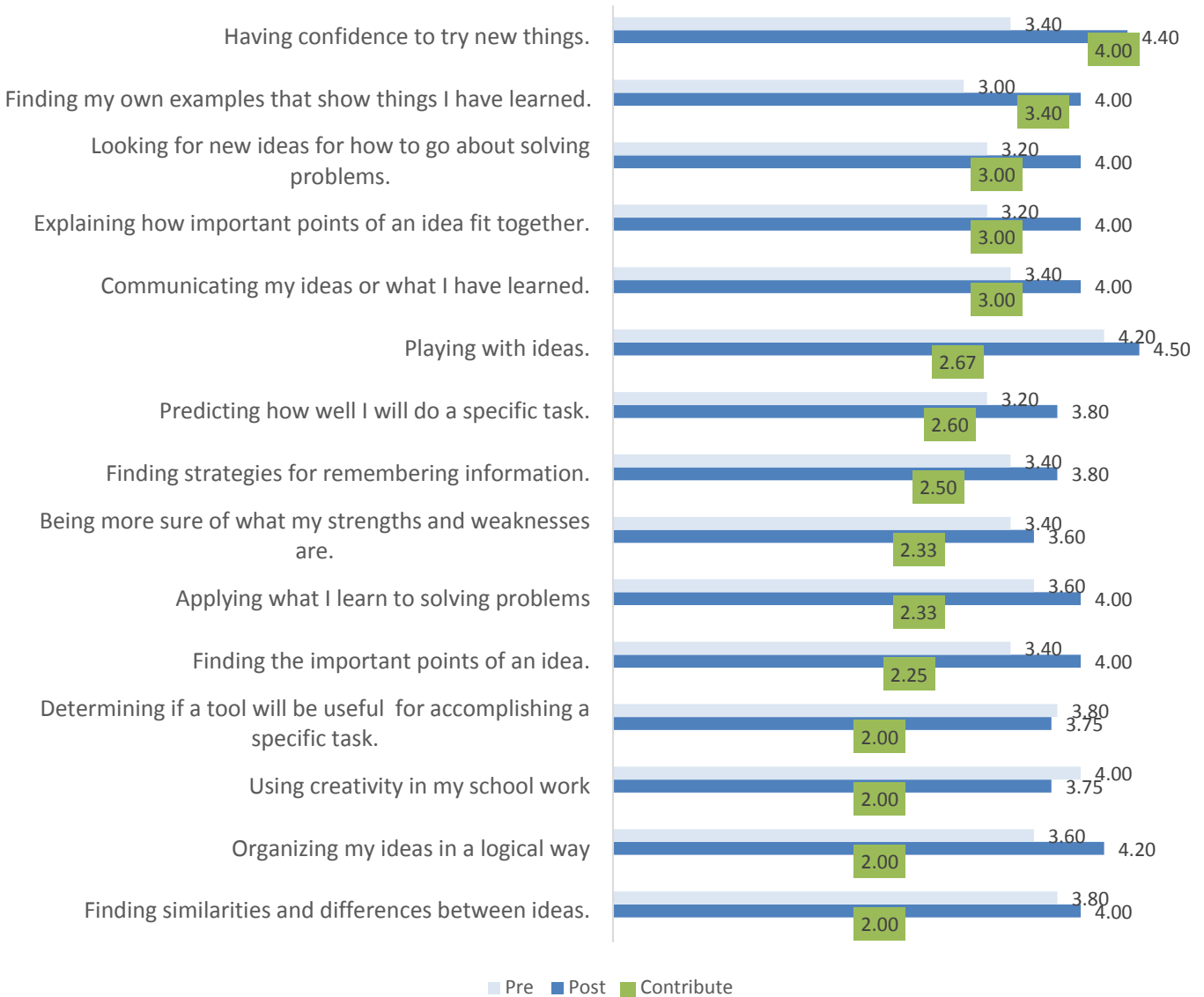


Figure 39. Q?Crew captain perceived changes in critical thinking (arranged by contribution scores).

Creative Thinking

Over the course of the summer Q?Crew captains discovered room for more creativity in the science process areas of “analyzing results of a scientific investigation; creating a graph for presentation to others; and asking questions that can be answered by collecting data (see Figure 40 where scale items are in order of greatest to least change). The items that indicated positive change included using scientific models to explain results, choosing and using science terms to share scientific results, communicating, and designing scientific procedures to answer questions.

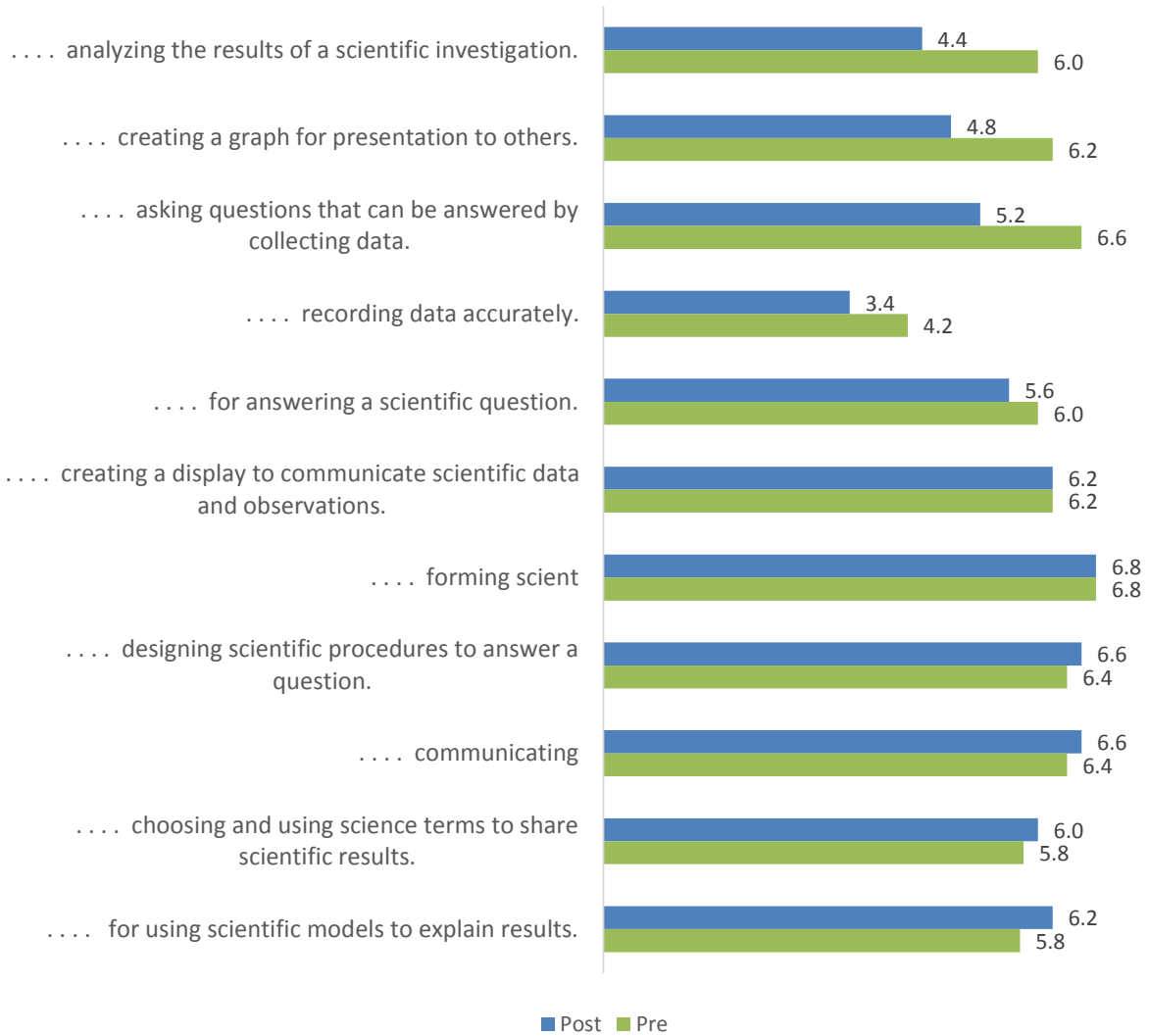


Figure 40. Per item changes in thinking creatively from prior to starting Q?Crew captains to after participation.

Q2. Results: ‘Teen Night Out’ Community Event and Investigation Workshops

Q2a. How the Teen Night Out community event functioned in the SCALE Pipeline

What we learned

Science Interest. All Science Night participants rated themselves as having at least some interest in science over the past 12 months. Most had moderately high interest.

Perceptions of the Teen Science Night Event. The event functioned to interest participants in visiting NMNH again and see more of the museum.

Most all participants also agreed that the event made them want to participate in more NMNH activities. Further, the event functioned to provide a social context for young people interested in science.

To the event’s credit, most all of the participants arriving with low-moderate interest and half the group with high-moderate interest felt that the event showed them science could be more interesting than they had thought.

Outreach and New Participation. The event reached new participants and interested them in further programming. Two thirds of participants said they had never previously attended any NMNH programming. Of this group, almost half wanted to be contacted for workshops, volunteering, or an internship; 53% wanted to be contacted about another evening event; and only two asked not to be contacted.

How We Know

Science Interest

Teens were asked to rate their interest in science over the past year on a scale of 1 (Not at all interested) to 10 (Extremely interested). On average, teens rated their interest in science over the past year as interested ($X=7.78$, $XD=1.55$). No teens selected had an interest less than 4. As shown in Figure 41, a majority of teens selected between 7 and 10. Teens who attended the TNO event arrived highly interested in science.

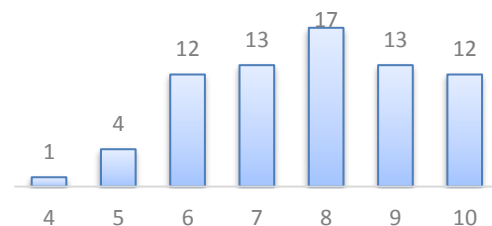


Figure 41. Science Interest over the past year, frequency.

Perceptions of Teen Night Out Event

Teens were asked to rate their agreement on a scale of 1 (strongly disagree) to 7 (strongly agree) how much they agreed with several statements regarding the Teen Night Out event. As shown in Figure 42, on average participants agreed with the first two statements, “This event made me want to visit NMNH again and see more of what’s here” and “This event made me want to participate in more NMNH activities.” They somewhat agreed with “ This event reassured me that there are groups of fellow science-interested people I can belong to.” and “This event made me think science might be more interesting than I thought.”

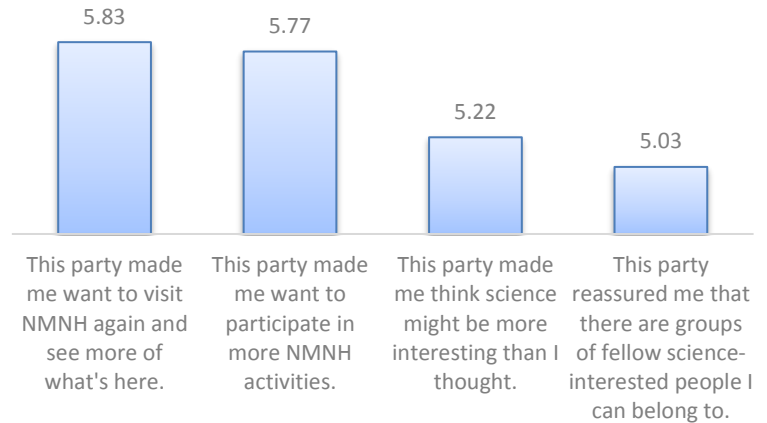
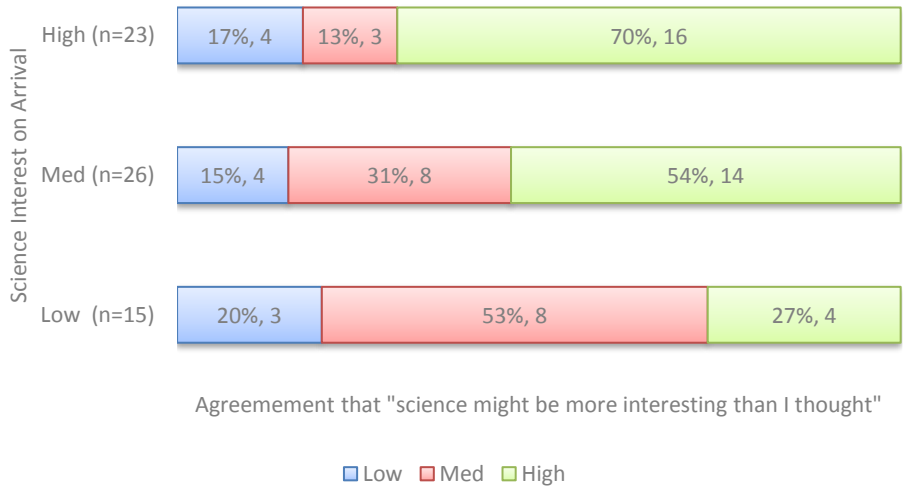


Figure 42. Average agreement (on a scale of 1 to 7) with statements about the Teen Night Out event.



Responses to the sense of belonging statement were highly correlated with science interest (Pearson $r(64)=.575, p<0.001$) such that **participants most interested in science felt most socially reassured.** Correlations with science being more interesting was less strong but positive

(Pearson $r(64)=.225, p=0.08$) such that interested participants became more interested; but (as illustrated in Figure 43) a few (7 of the 23 in the interest group and 4 of the 26 in the medium interest group) became less interested. **Most all of the low interest group became more interested and half of the medium interest group became more interested.**

Teens on average agreed with the statement that the Teen Night Out event made them want to visit the museum again to see more of what is there ($X=5.83$, $SD=1.28$). A majority of responses indicated “strong agreement” to wanting to visit NMNH in the future (Figure 43). This could show that the event had an impact on desire to return to NMNH in the future, and could result in returned visits.

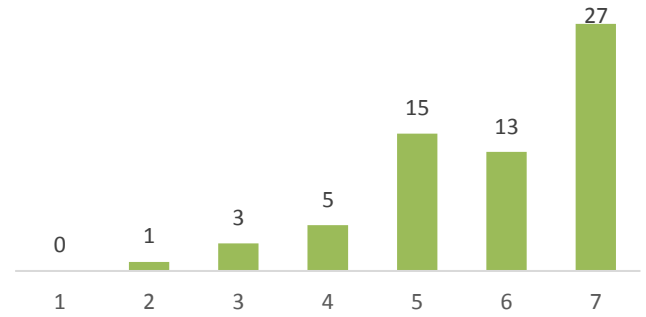


Figure 43. Distribution of “science might be more interesting than I thought” responses by science interest at arrival.

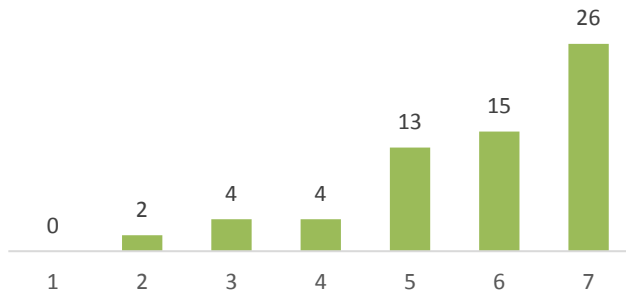


Figure 44. Frequency of level of agreement to “This event made me want to participate in other NMNH activities”,

A majority of teens “strongly agreed” that they would like to participate in more NMNH activities due to the Teen Night Out ($X=5.77$, $SD=1.38$). Of the 64 responses, 54 somewhat agreed, agreed, or strongly agreed that they were interested in participating in more NMNH activities (Figure 44). For the pipeline,

the TNO event seems to provide teens with an interest in attending future programming. Given that TNO teens are already interested in science, combining this event with other efforts to gain volunteers, workshop attendees, or interns could be effective.

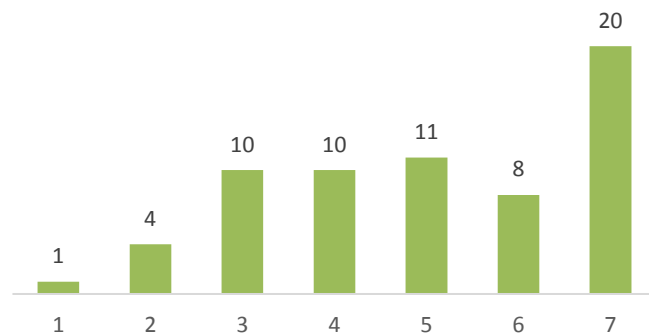


Figure 45. Frequency of level of agreement to “This event reassured me that there are groups of fellow science-interested people I can belong to”, $X=5.03$, $SD=1.74$.

On average, teens “somewhat agreed” that the Teen Night Out event reassured them that there are other science interested people that they can belong with ($M=5.03$, $sd=1.74$). Agreement was more varied, respondents were split almost equally between the Strongly Disagree to Neutral group and the Somewhat Agree to Strongly Agree group. **For many science interested teens, the TNO event functioned to provide social reassurance.**

Recommendation: This social benefit could be utilized to help attract youth to future events and the other youth programs.

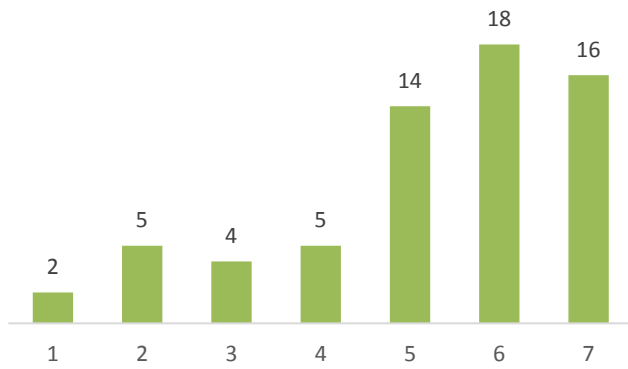


Figure 46. Frequency of level of agreement to "This event made me think science might be more interesting than I thought", $X=5.22$, $SD=1.68$.

On average, teens “slightly agreed” that the Teen Night Out event showed them that science is more interesting than initially thought ($X=5.22$, $SD=1.68$). The majority of teens Slightly Agreed, Agreed, or Strongly Agreed, with the statement. Given that most teens were already interested in science, that so many became more interested after attending could show that exposure to new topics, fields of science, or processes could lead to more interest in return visits or future programming attendance.

Outreach and New Participation

About two thirds (69%) of teens said they had not previously participated in any NMNH programming, one-third (31%) said they had (Figure 47). This means that the TNO event is reaching new teens. This is ideal for trying to broaden audiences and to get new teens involved with future NMNH programming.

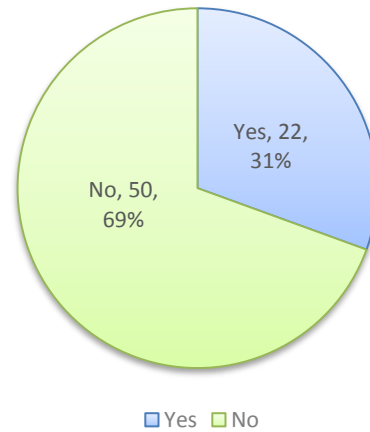


Figure 47. Proportion of respondents who had previously participated in NMNH programming

What is Next?

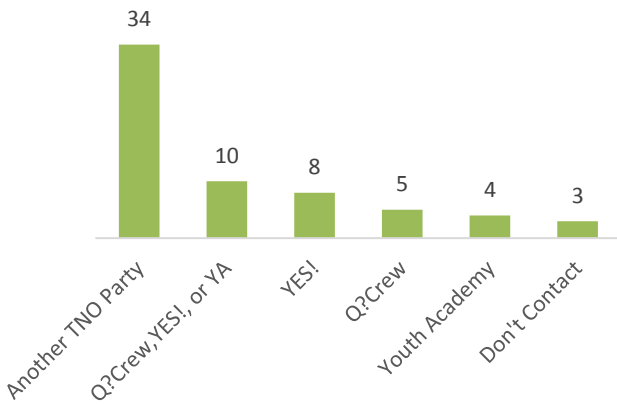


Figure 48. Distribution of reasons to be contacted by NMNH in the future.

Respondents were asked how or when they would like to be contacted again by NMNH in the future. Most of the teens (n=34, 53%) said that they would like to be contacted when NMNH was having another one of the Teen Night Out parties. More information on Q?Crew, YES!, and the Youth Academy series was the next most popular choice (n=10, 16%). Of these, an equal number of about half (n=4) wanted more information on Q?Crew or on YES! (see Figure 48). About 13% of teens (n=8) wanted more information solely about YES! internships, about 8% (n=5) for information only

about Q?Crew volunteer opportunities, and about 6% (n=4) for information on Youth Academy experienced. Three respondents asked to not be contacted further (see Figure 49). Though most were interested in other parties, providing more opportunities for networking or potentially connecting with Q?Crew or YES! teens could help boost interest in other NMNH programs. Of those who had not previously been involved with NMNH activities, 42% wanted to be contacted for workshops, volunteering, or an internship; 53% wanted to be contacted about another event; and only two asked not to be contacted.

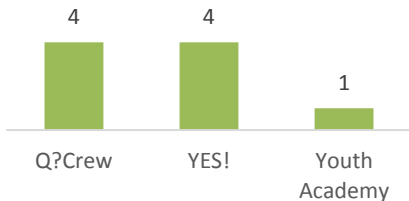


Figure 49. First choice of program to be involved in and contacted about.

Q2b. How the Natural History Investigation Series Workshops Affected Participants and Functioned in the SCALE pipeline.

What We Learned

Participants arrived to both the 2018 and 2019 workshops very interested or extremely interested in participating in YES! or Q?Crew. Approximately two thirds of participants experienced a change in that interest—although that change occurred in both directions--equally as many participants became more interested as those who became less interested. This finding suggests that the workshops functioned in the pipeline both to generate interest and also to function to help students self-select, perhaps, for instance, helping them to understand the realities of the commitment to these programs.

Recommendation: Recognize and build into programming these programs’ dual roles in the NMNH youth education pipeline.

Pre workshop intentions and programming. Most participants chose to enroll in workshops because they wanted to learn more or because they were excited or enthusiastic about the workshop topics. Just less than a quarter of participants had attended teen night out and of that group, half found the event important to their decision to sign up for a workshop.

Effect on interest in applying to YES! or Q?Crew.

Overall, the workshops had only minor, if any, effect on participants’ interest in applying to YES! or Q?Crew.

Effect on attitudes toward science and museums. In general the workshop had at least some effect on most all participants’ attitudes toward science and museums (87%) with least effect on visiting other Smithsonian museums (65%). Explanations of effect on studying science in school were primarily affective (involving feeling more “knowledgeable,” “prepared,” “inspired” and “confident”). Similarly, explanations of effect on returning to NMNH were also primarily affective expressions of feelings such as “intrigued,” “engaged,” “excited,” associated with the museum, the exhibits, and returning as a visitor. Description of the effect on visiting other Smithsonian museums generally involved either cognitive (interest) or affective (enthusiasm, excitement) explanations. Finally, the participants who indicated an effect on their interest in science mostly described the effect as being more interest in the specific topic of their workshop—botany, ornithology, or paleontology. All but three participants (97%) perceived at least some effect on at least one of these topics.

Effect on academic or career intentions. Approximately half the workshop participants reported the workshop had at least some effect on their intention to pursue a Natural History major in college (49%); a career as a researcher (51%) or a career in a museum (47%); and a quarter (27%) on their intention to pursue a career as a science educator. Within these groups, just over half perceived high effect. However, this effect was less than the workshop effect on interest in science and museums. Of the 88 participants, 63 (72%) perceived at least some effect on at least one of these topics.

Effect on Science Identity. No significant changes could be detected in workshop participants' science identity.

Effect on Interest in pursuing Natural History academically. Half of all participants perceived themselves as having greater intention to pursue a Natural History major in college. More specifically, half of the participants not interested in pursuing a natural history major prior to the workshop (14%) were considering it after the workshop; half of the moderately interested (33%) became highly interested, and half of the highly interested (53%) were even more interested.

How we know

Reason for Attending

Participants were asked to explain the reason for choosing to participate in the workshops. Of the 88 Winter (2018) workshop series respondents, most gave cognitive explanations, with affective explanations the second most frequent. This distribution across categories were similar across all three workshops. Among the 20 single (2019) entomology workshop participants the responses were similar. Thus, the summaries within each theme listed below are for all three workshops together.

Participants most commonly responded with cognitive themes about interest to learn more and expand knowledge. Some wanted to learn more about specific topics like forensic anthropology or botany, while others just wanted to learn more about science in general. A good example of the cognitive theme responses states; *"I am interested in forensics and anthropology and wanted to delve deeper into these topics"* or, from the Entomology workshop, *"I chose to participate in this workshop series to expand my knowledge to different areas of science I don't know much about...."*

Affective responses, the second most frequent type, included positive reasons such as enjoyment, love, or excitement towards science in general or toward specific topics. Some participants referenced enthusiasm for the opportunity to attend workshops at NMNH specifically. Some examples of the kinds of excitement responses included;

"When I saw there was a botany class I was excited because I have never had a class solely focused towards that subject";

"I chose to participate because I enjoy science and would love to learn more";

"From a young age I have enjoyed museums but the Natural History museum has been my favorite and my favorite part is how science is used in such an interesting way to educate the public".

Similarly, the entomology workshop produced comments such as:

“I chose to participate in this workshop series because of my strong passion for science...;”

“I really like nature and the wildlife in it.”

Responses with the utility theme included the opportunity to handle specimens and practical lab experiences in their reasons for attending. One participant explained; “I am homeschooled and I don’t get a lot of lab experiences, so I’m excited to do some hands-on work with specimens”. Another said; “I am excited to do this class at the NMNH because they have so many great specimens for us to learn from”.

Most of the responses with a referral theme included that a family member or school encouraged them to participate. Less common referral sources included friends, marketing materials (Q?rius website, flyer), or a previous visit to NMNH. From the entomology workshop, three respondents mentioned referral, one stating that their mom suggested the opportunity; *“My mom noticed it a little while ago”*; another other stating that they had *“been waiting for such an opportunity to arrive”*; and finally one respondent’s school had recommended the program.

Three responses involved reference to past experience with NMNH as being their reason for participating. One responses explained; “I have...been going to the Natural History Museum since I was very young and I am excited to learn more about the museum and the people there”. The other two responses explained that they had participated in other programs previously, including Q?rius classes.

All responses with the future participation theme involved desire to participate in the YES! internship during the summer and that participation in the workshop would strengthen their applications.

The career themed responses centered on interest in pursuing careers in science fields and interest in learning about potential career opportunities. One responses stated; “I am interested in botany and hope to pursue it later in my future”. Another said: “This is a fantastic opportunity to get a window into the career field I intend to pursue”.

Four responses included school themes. Three explained how participation would provide credits towards a school curriculum or homeschool electives. The other explained that they hoped it would help build an application to college.

A few responses included the interpersonal theme, listing interest in being able to connect with peers with similar interests. Some examples included:

“...this is an opportunity to...meet people who are also interested in the same field as me”;
“meet other kids who are also interested in science”.

‘Teen Night Out’ - Attendance

Of the 88 participants, 19 (21.6%) had attended the Teen Night Out event. These participants rated their attendance at Teen Night Out as being “moderately important” to their decision to sign up for the workshop ($M=3.32$, $SD=1.38$), i.e., 4 considered teen night out as very important and 5 considered it extremely important. In other words, just less than a quarter of participants had attended teen night out and of that group, half found the event important to their decision to sign up for a workshop. These proportions did not differ by workshop (Kruskal Wallis $X^2(2) = 3.59$, $p=.17$). Also, across the three workshops, the number of participants who attended teen night out did not significantly differ ($X^2(2) = .89$, $p=.64$).

Entomology responses were very similar. Of the 20 participants, 4 (21.1%) had attended the Teen Night Out event. These participants rated their attendance at Teen Night Out as being “slightly important” (to their decision to sign up for the workshop ($M=2.25$, $SD=0.50$), i.e., 3 considered teen night out as slightly important and 1 considered it moderately important. In other words, just less than a quarter of participants had attended teen night out, though those that participate did not highly attribute their workshop attendance to participation in the evening introductory event.

Recommendation: These findings suggests the need to look for more direct connections between the two types of events. These connections could be logistic (signing up for a workshop at the event) or thematic (e.g. desiging workshops (or their beginning or end) to continue the fun and entertaining theme).

Workshop Effect on Interest in Applying to Q?Crew and YES!

Overall, at both time periods, participants arrived at the workshops very interested or extremely interested in participating in YES! or Q?Crew. In both cases, as can be seen in Figures 52 and 52, the workshops had only minor, if any, positive effect on this interest. More specifically, Wilcoxon signed rank comparisons revealed no significant differences either workshop: (2018 series: Q?Crew $z=-1.24$, $p=.21$; YES! $z=-.68$, $p=.49$; (Q?Crew $z=-1.27$, $p=.21$) or YES! ($z=-.45$, $p=.66$)). However, the counts and directions of change are also noteworthy. At both time period, equal numbers of participants became more interested as less and also to similar degree.

This finding suggests that the workshops functioned in the pipeline both to generate interest and also to help students self-select, perhaps, for instance, helping them to understand the realities of the commitment to these programs.

Recommendation. Recognize and build into programming these programs' dual roles in the NMNH youth education pipeline.

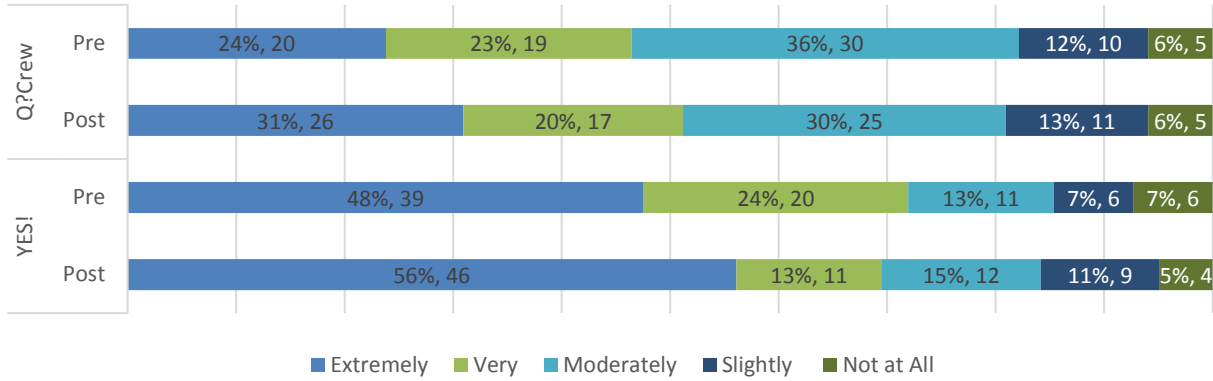


Figure 50. Pre and Post 2018 Workshop Series Interest in applying for NMNH programs

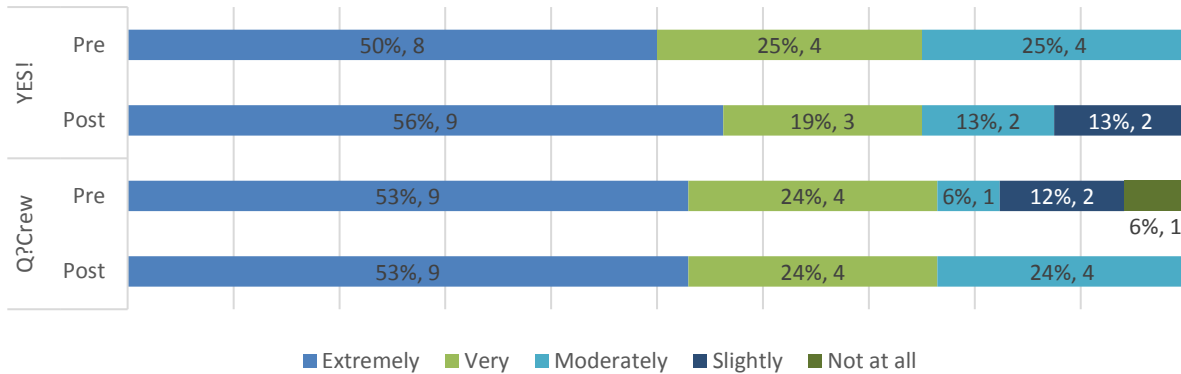


Figure 51. Pre and Post 2019 Workshop Interest in applying for NMNH programs

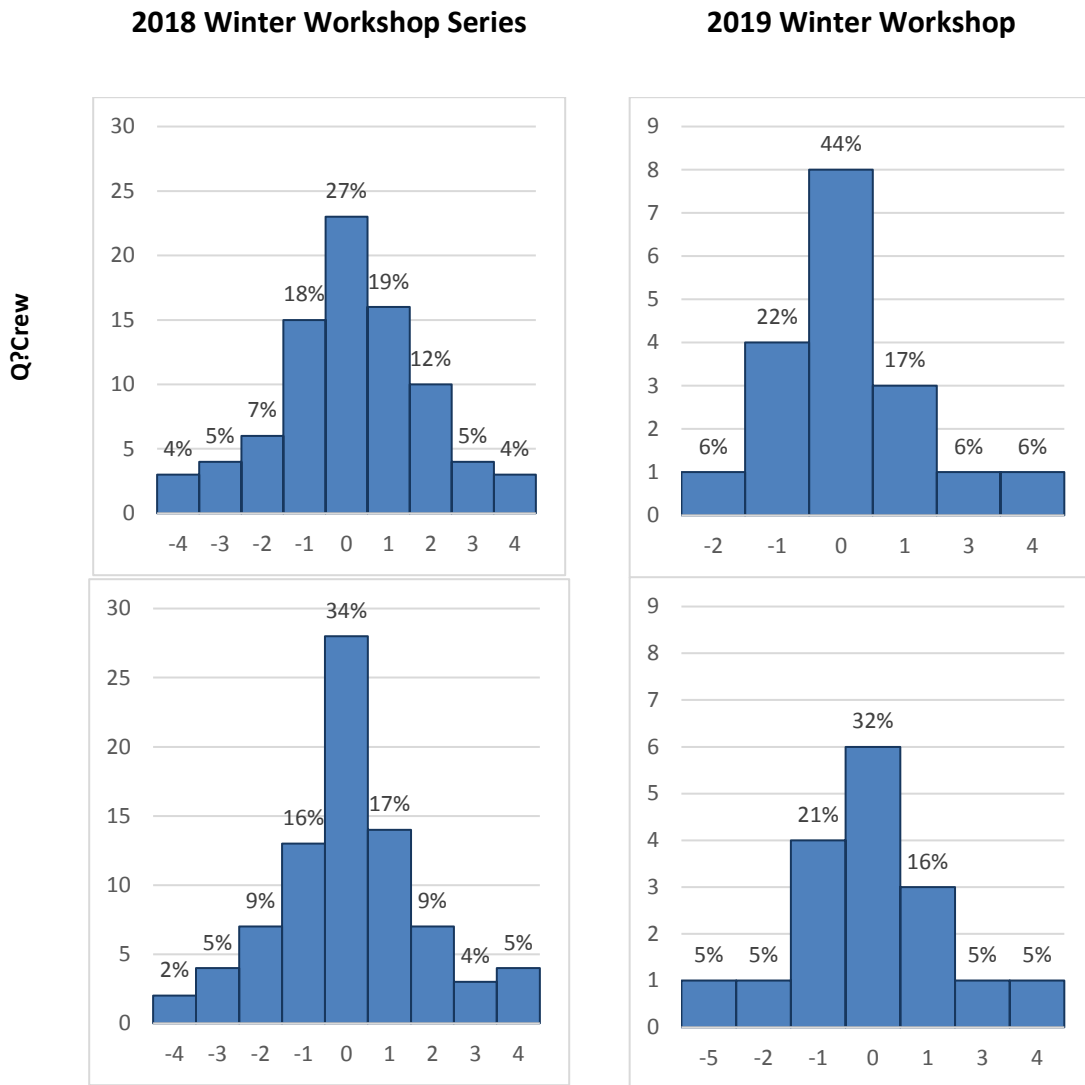


Figure 52. Counts and direction of change in interest in leadership programs

Effect on Attitudes toward Studying Science and Visiting Museums

After the workshop, participants responded to four questions about the workshop effect on their attitude toward science and museums. They also responded to an open ended prompt to explain the effect if there was one. Table 6 shows that across three of the four outcomes (all but visiting another Smithsonian museum) almost all (87% of the 86 respondents from the 2018 workshop series and 75% of the 19 respondents from the 2019 workshop) perceived at least some effect.

As shown in Table 6, across both workshop offerings most of the participants who experienced some effect described that effect as high. Thematically they described the effect in terms that were primarily cognitive (I will learn more) or affective (I'll be excited or more interested in . . .) Distribution of themes across the four attitude toward science and museum outcomes can also be found in Table 6.

Table 6. Strength of effect and relative distribution of themes across outcomes related to attitudes toward science and museums.

Outcome	n	Effect Strength				Themes						
		None	Low	Med	High	Cognitive	Affective	Career Orientation	Utility	Future Participation	Interpersonal	
2018 Workshop Series												
Study Science in School	75	12 (14%)	8 (9%)	17 (20%)	50 (58%)	•	◆	o	o			
Visit NMNH	76	11 (13%)	6 (7%)	14 (17%)	56 (64%)	◆	◆			o		
Visit Other Smithsonian	56	30 (35%)	8 (9%)	13 (15%)	35 (41%)	◆	•	o	o	o		
General Interest in Science	56	11 (13%)	8 (10%)	17 (19%)	50 (58%)	•	◆	o	o			
2019 Entomology Workshop												
Study Science in School	16	4 (25%)	0 (00%)	1 (06%)	11 (69%)	•	◆	o	o	o		o
Visit NMNH	17	1 (06%)	1 (07%)	3 (20%)	12 (71%)	◆	◆			o		
Visit Other Smithsonian	17	2 (12%)	1 (07%)	5 (32%)	9 (50%)	◆	◆					
General Interest in Science	17	1 (06%)	0 (00%)	2 (12%)	14 (82%)	◆	•	o	o	o		

◆ = ≥50%, • = 49-25%, o = <25%

Studying Science in School

Of the 87 2019 workshop series responses, 75 (85%) reported that the workshop had at least some effect on how they feel about studying science in school. Most (58% in the workshop series and 69% in the 2019 workshop reported high effect. In the 2019 workshop, 12 of the 16 (75%) reported some effect. Thematic explanations for “some effect” are described below:

The most common type of explanation involved affective expressions of increased comfort or confidence towards science in general and toward studying science in school. Some of these positive moods and emotions included feeling “excited,” “open,” “confident,” “enthusiastic,” “motivated,” “confident,” and “engaged.” Some examples included “[I will feel] inspired and connected to the real world in science class”; “[I will feel more...] confident in myself”; and “[I will feel more...] comfortable doing research”.

Examples from the 2019 entomology workshop included “[I will feel] eager to learn more about animal biology”; “[I will feel more...] enthusiastic about handling creatures”; and “[I will feel more...] engaged in science topics that were not interesting to me”.

Also frequent were explanations of cognitive knowledge or interest in learning referencing feeling “knowledgeable” or “prepared”. Some examples include “[I will ...] *understand more things easier in [science] classes*”; “[I will feel more...] *experienced during labs*”; and “[I will feel more...] *prepared to study science related topics*.” From the entomology workshop examples included “[I will feel...] *interested, appreciative, and curious*”; “[I will feel more...] *interested in taking class with a more specific focus in animals*”; and “[I will feel more...] *interested in biology classes that include living insects since they are great creatures with a lot of mysteries and qualities*.”

Utility-type responses included the ability to connect what is learned about in science classes—including specific facts and topics as well as scientific methods and logic—to the real-world. Responses largely centered on the ability to see practical uses in the methods and information learned. Some examples include; “[I will feel more...] *able to...reflect on how what we’re studying affects us in the real world*”; “[I will feel more...] *able to apply what I learned to the real world*”; and “[I will be...] *using the ‘how science works’ model in my future scientific endeavors*”.

Three responses included career-orientation type themes. They varied in details including one response that talked about an upcoming internship at school, one that stated an openness to new careers including botany, and another that explained that should this respondent pursue a career in a natural history related field that they would feel confident about what that career entails and capable to perform in that career. An entomology workshop response mentioned how participation motivated the respondent to “*...get good grades so I can pursue a career in science*”.

One response mentioned greater confidence in interpersonal-type themes, stating that they feel able to speak with their science teachers after the workshop.

One response from the entomology workshop mentioned an interpersonal reasons that the student would feel more “*...excited to learn and help my peers*”.

Returning as a Visitor to NMNH

Of the 87 2018 workshop series responses, 76 (86%) selected that the workshop had at least some effect on how they feel about returning to NMNH as a visitor.

The most common type of explanation involved a wide range of affective expressions of positive moods and emotions associated with the museum, the exhibits, and returning as a visitor. Some of these included feeling “intrigued,” “engaged,” “excited,” “encouraged,” “connected,” “confident,” “eager,” and “welcome.” Some examples included “[I will feel more...] *engaged in the science behind*

the exhibits”; “[I will feel more...] of a connection to NMNH”; and “[I will feel more...] excited to come because I know a bit more about the behind the scenes work done there”. Entomology descriptors additionally included “beneficial”, and feeling “at home” with explanations such as “[I will feel more...] engaged in the science topics that I was not interest[ed] in before”; “[I will feel more...] inspired to take a further look into the insect collection”; and “[I will feel more...] encouraged that I can participated more at the museum”.

Cognitive responses largely stated interest in returning to the museum or to learn more about specific exhibits when visiting. Some responses included feeling experienced or knowledgeable about exhibits or behind-the-scenes working in the museum. Some examples included *“[I will feel more...] interested in the exhibits and about what goes on behind-the-scenes of the museum”; “[I will feel more...] interested in forensic anthropology as a whole;” and “[I will feel more...] experienced with the facilities”.* Entomology responses included understanding or interest in entomology or museum work. Some responses included feeling knowledgeable or interested specifically in museum exhibits. Some examples included *“[I will feel more...] focused in regards to learning more in new exhibits”; “[I will feel more...] interested in taking part in its work;” and “[I will feel more...] know where things are and what things are”.*

The future participation-type responses included interest or intention to participate in other opportunities at NMNH, through programs or classes. Some examples include *“[I will feel more...] inclined to take youth programs at NMNH”; “If there are more opportunities to attend classes at NMNH, I will definitely attend”; and “[I will feel more...] excited than before to return, likely to use Q?rius lab”.* One response included that their family will be keeping up to date with future opportunities. Entomology responses also included mentions of future participation. One stated; *“[I will feel more...] willing to participate in future workshops since I know what to expect and they talk about topics I am interested [in]”.* Another was more general in their future participation stating; *“[I will feel more...] encouraged that I can participate more at the museum”.*

Three responses expressed interest in interpersonal communication including advising others to participate, exploring the museum with others, and being more open to *“discussing with other visitors about their interests and teaching each other”.*

Visiting other Smithsonian Museums

Of the 86 responses, 56 (64%) selected that the workshop had at least some effect on how they feel about visiting other Smithsonian museums. Among entomology participants the proportion was a bit higher (88% of the 17 responders). Most all responses described either cognitive (interest) or affective (enthusiasm) explanations of the effect.

Affective responses mostly described excitement at the prospect of exploring other museums. They also included feeling more “inclined,” “empowered,” and feeling more welcome and comfortable.

Some examples included; “[I will feel ...] more empowered to visit other museums”, and “[I will feel more...] excited in regards to finding things that relate to my interests at other museum”. One response included that their excitement and interest in visiting other museums was because they “...understand more of what is going on behind the scenes”.

Among the cognitive-type responses, nearly all stated feelings of being interested in seeing other museums, often explaining that they’re interested in exploring what other museums have in exhibits and artifacts. Affective responses mostly described excitement at the prospect of exploring other museums. They also included greater feelings of comfort, motivation, and feeling more welcome to visit other museums. Some examples included; “[I will feel ...] eager to explore at other Smithsonian museums in D.C.”, and “[I will feel more...] that the memories from the program will encourage me to visit more exhibits”. One response included that the interest in visiting other museums was because “I had a great experience at the workshop.” From the entomology workshop, nearly all stated feelings of being interested in seeing other museums or science areas. Some examples included; “[I will feel more...] interested in attending since the entomology workshop was full of learning so I know that I will get a lot from attending other museums”; “[I will feel more...] interested about behind the scenes”; and “[I will feel more...] like they have a lot of interesting experiences to offer”.

A few responses simply indicated intent to participate in future programs or visits to museums. Some examples include; “[I will feel more] inclined to attend other museum programs in different museums;” “[I will feel more] interested...to involve myself in programs, events, etc.,” and “[I will feel more] likely to visit other Smithsonian museums and see what they have to offer.”

Two responses included interpersonal-type themes. One response indicated being interested in communicating with scientists stating; “[I will feel more] excited to learn from... the museum scientists”. The other response indicated inclination to bring friends to visit; “[I will feel more] inclined to bring my friends to visit”.

General Interest in Science

Of the 86 responses, 75 (87%) selected that the workshop had at least some effect on their general interest in science. After the entomology workshop, 94% (16 of 17) reported at least some effect. In contrast to studying science in school or visiting NMNH about which participants primarily responded affectively, workshop series respondents primarily responded cognitively to explain the workshop effect on their general science interest. These cognitive type responses indicated greater interest in science or specific science topics including botany, ornithology, or paleontology. A few responses indicated being more knowledgeable about and open to learning about new fields of study. From the entomology group, cognitive responses *involved* emphasis on investment or exploring new fields of science and more details of what they have already starting studying. Some examples included; “[I will feel more...] interested in moving into details”; “[I will feel more...] strongly towards the general exploration of the scientific fields”.

The primarily cognitive responses from the 2018 workshop series also contrasted with those from the entomology workshop participants who primarily responded affectively and about feelings of confidence or motivation. . Some examples included; *“[I will feel more...] confident about working with insects and since that falls in Biology I think I’ll be more willing to work with living organisms in class”*; *“[I will feel more...] excited to teach more people about science and spread a love of science”*. Affective comments from the workshop series noted feeling “exhilarated” “eager,” “confident,” “encouraged,” “comfortable,” “motivated,” and “inspired.”

Some responses involved career-oriented themes listing interest, knowledge, or excitement regarding a career in science or learning about new career fields. One, from the entomology group stated *“[I will feel more...] that I know what a scientist does and how to prepare to be a scientist”*.

Comments codes with utility type themes demonstrated feelings of skills gained or a more practical understanding of science. One stated greater real-world knowledge, stating that they are “inclined to look at doing science as a cycle not as a process”. Another response said that with their workshop experience they feel more “capable of doing science”. An example, from the entomology workshop noted practical skills and knowledge; *“[I will feel more...] used to the scientific process and how scientists learn about the world”*.

Finally, a couple of responses included future participation stating; *“Inspired to participate in scientific workshops”* and “want to attend more classes like this”. From the entomology workshop: *“[I will feel more...] inspired to seek out more opportunities to further my learning and understanding of science”*

Interpersonal-type theme responses (both from the 2018 workshop series, =indicated excitement to “meet with and talk to with real scientists” and eagerness to “Share my new knowledge”.

Effect on Future Academic or Career Interests

Participants also responded to four questions about the workshop effect on their academic and career interests. As with the question about amount of effect on studying science and visiting museums, they also responded to an open ended prompt to explain the effect if there was one. Figures 54 and 55 shows, across the four outcomes, for those related to interest in a natural history major, a career as a researcher and a career in a museum, approximately half, or more, of the 19 participants perceived at least some workshop effect. For the outcomes related to interest in a natural history major in college as well as a career in a museum approximately three quarters of participants said that the workshop had at least some effect. For the sake of comparison, results for attitude toward science and museums are also provided and show that perception future effect was generally less frequent than current effect.

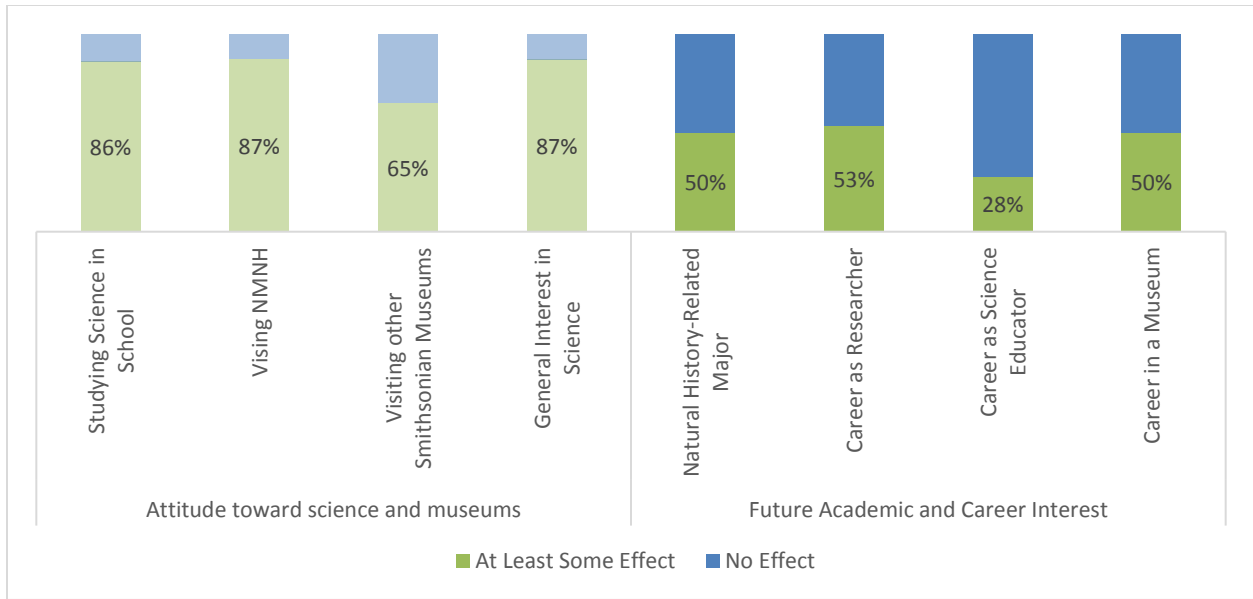


Figure 53. Perception of effect of 2018 series workshops on attitude future academic and career interests (with comparison to effect on attitude toward science and museums; N = 86)

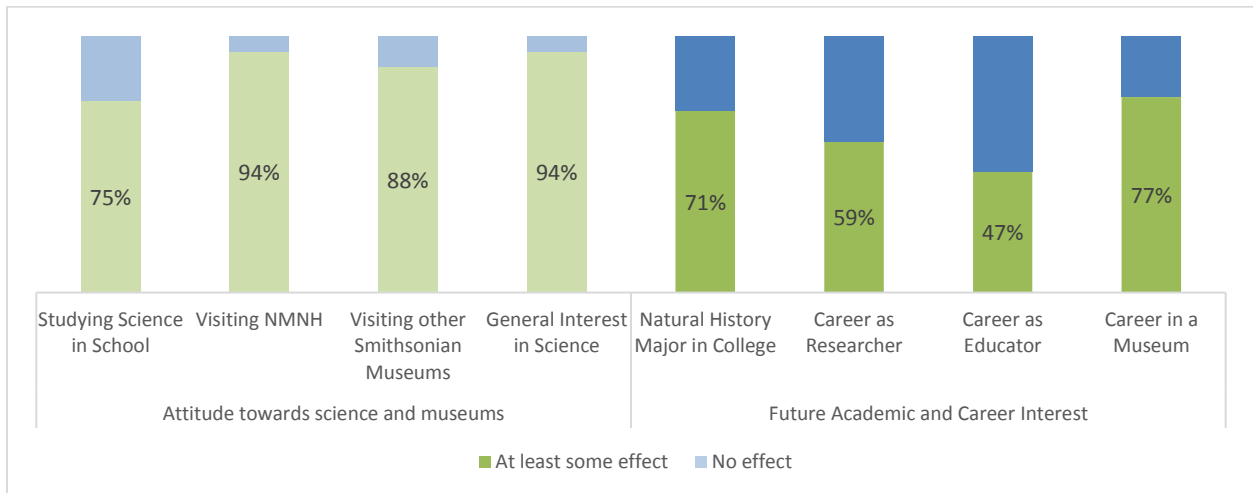


Figure 54. Perception of effect of 2019 entomology workshop on attitude future academic and career interests (with comparison to effect on attitude toward science and museums; N = 19)

As shown in Table 7, across both 2018 workshops and the 2019 entomology workshop most of the participants who experienced some effect described that effect as high, with the exception of the effect on interest in a career as a science educator where the medium and low effect counts were equal and not significantly different than the high effect amount. Thematically, as with the attitude

toward science and museum outcomes, most participants who experienced any effect on future academic or career interest described that effect as either cognitive (I will know more) or affective (I'll be excited about . . .), with affective being the more common..

Table 7. Strength of effect and relative distribution of themes across outcomes related to future academic or career interests.

Outcome	n	Effect Strength				Themes						
		None	Low	Med	High	Cognitive	Affective	Career Orientation	Utility	Future Participation	Past Participation	Interpersona
2018 Workshops												
Natural History Major	86	43 (49%)	3 (3%)	14 (16%)	26 (30%)	•	•	o				o
Career as a Researcher	86	41 (47%)	6 (7%)	12 (14%)	27 (31%)	◆	•	o	o			o
Career as Science Educator	86	62 (72%)	2 (2%)	10 (12%)	12 (14%)	◆	•	o		o		•
Career in a Museum	86	45 (52%)	7 (8%)	10 (11%)	24 (28%)	•	◆	o				o
2019 Entomology Workshop												
Natural History Major	17	5 (29%)	0 (00%)	5 (29%)	6 (36%)	•	◆		o			
Career as a Researcher	17	7 (41%)	0 (00%)	1 (06%)	9 (53%)	•	•	•				
Career as Science Educator	17	9 (53%)	3 (19%)	3 (18%)	2 (12%)	•	•	•				
Career in a Museum	17	4 (24%)	3 (19%)	3 (18%)	7 (41%)	o	◆	o	o			

(◆ = ≥50%, • = 49-25%, o = <25%)

Pursue a Major Related to Natural History

Of the 86 2018 workshop series respondents, 43 (50%) reported at least some positive workshop effect on feelings about pursuing a Natural History major in college. Almost half (46%) rated this effect as moderate or high. Of the 17 2019 entomology workshop respondents, 12 (71%) reported at least some workshop. Two thirds (65%) rated this effect as moderate or high.

The cognitive–type responses generally grouped into two categories. The first involved statements that expressed interest or curiosity about learning opportunities in college in Natural History fields, Some examples included: “[I will feel] Interested in that field because the workshops showed me the interesting part of the field;” and “[I am] curious about opportunities in college.” From the entomology workshop, “[I will feel...] interesting in investigating in the field of natural history”. The second group included being more knowledgeable or familiar regarding Natural History subjects, sometimes attributing this knowledge to hands-on-experience in the workshops. Some examples included: “I have more knowledge about the subject which might possibly make me want to pursue it;” and “[I will feel more] familiar with the subject and with the way it is applied in real life since I had hands-on experiences” And from the entomology workshop: “[I feel more...] as if I know how history

*science affects me and others, and how I can use historical evidence to help modern day science".*The affect-type responses conveyed excitement and motivation to continue learning about Natural History fields in college or to pursue a Natural History related major. Some examples included; "[I feel] inclined to pursue some sort of natural science unlike before"; "[I feel] excited for college because I want to study anthropology"; "[I will feel] eager to explore and learn about science". From the entomology workshop, examples included: "[I feel more...] excited because I have seen what scientists get to do and I will have more motivation"; "[I feel more...] confident about science"; "[I will feel more...] excited since majoring in science had been my dream to pursue and also science helps us in a lot we do". Many responses included career orientation-type themes including interest in pursuing a Natural History major, often in conjunction with an interest or desire in a Natural History related career. Some examples included; "Interested in pursuing a biology-related career;" "Confident I can pursue a good career with this knowledge;" and "Excited to pursue a Natural History career/major in college."

One response included the interpersonal-type theme stating that they feel ambitious towards pursuing a Natural History major with the intent to share their discoveries with others.

One response from the entomology workshop directly attributed future academic pursuit to the workshop experience.

Career as a Researcher

Of the 86 2018 workshop series respondents, 46 (%) reported at least some positive workshop effect on feelings about pursuing a career as a researcher in a Natural History field. Almost a third (31%) perceived a high effect. Explanations tended to be more cognitive than affective. Of the 17 2019 entomology workshop respondents, 10 (59%) reported at least some workshop effect. All rated this effect as moderate (one of the ten) or high (nine of the ten). Explanations were equally cognitive and affective.

Cognitive themed responses involved interest, focused on either the research process ([I will feel more] interested in the data I would be trying to find and analyzing it and observing); the research objectives ([I will feel more] interested in adding to the body of knowledge in natural sciences); or the career overall ([I will feel more] aware of research opportunities because of my experience in the workshop." From the entomology workshop, cognitive themed responses involved interest, focused on working in the field ([I will feel more] interested in working in the field); the importance ([I will feel more...] that I understand the importance of research and how it can help the world); and an understanding of what a researcher might do overall 9[I will feel more...] like being a researcher offers interesting experience and I could still go into the field as a researcher).

Affective themed response included a variety of positive emotions or moods such as "thrilled," "comfortable," "confident," "excited," and "hopeful" about a career as a researcher. One response

elaborated saying “[I will feel more] likely to invest my time in learning more about what it takes to specialize in these fields”. Another said “[I will feel more] comfortable in researching similar areas, confident in questions I ask.” From the entomology workshop, affective themed response included a variety of positive emotions or moods such as “happy,” “appreciative,” or “inclined” about a career as a researcher. One response elaborated saying “[I will feel more...] appreciative of the work that is done and I want to help preserve the environment”. Another said “[I will feel more...] happy researching different objects as a science student...”

A few responses included career oriented themes listing specifics of desired career paths. One response said “[I will] get to travel, see places, meet new people you work with” another explained “[I will feel more] comprehensive about how botany could be used within medicine, my desired career path, so I’d love to discover medicine etc. from plants”. One response was negative explaining “I don’t think I want to pursue it as a career.” From the entomology workshop, responses included specific fields or how a career could impact the scientific community. One response said “[I will feel more...] inclined to pursue the career of forensics in regards to entomology” another explained “[I will feel more...] leaning towards researching for data since it will bring results that can be able to make a great impact in the science community”. One response was more pragmatic explaining “[I will feel more...] interested, but careers as a researcher are very difficult to obtain.”

The responses with utility themes included feeling more capable and prepared for doing research due to microscope skills and a realistic look at research as a career (“[I will feel more] realistically interested in being a researcher.”

One response included the interpersonal theme saying “[I feel more] confident that I will meet people who will help me progress.”

Career as a Science Educator

Of the 86 2018 workshop series respondents, 24 (28%) perceived at least some workshop effect on intention to pursue a science educator career. From the 2019 entomology workshop responses, the proportion was higher. Of the 17 responses, 8 (47%) perceived at least some workshop effect. About a third (30%) rated the effect as moderate or high.

About half of the 2018 responses included a cognitive theme, most stating an interest in an educator career. One response explained how the workshop changed their interest saying “[I will feel more] interested in pursuing a natural history subject in a career as an educator because...I also observed how much fun the educators at this program had while teaching the students in the class.” Another explained the effect of observing the workshop educators: “[I will feel more] inclined after seeing how happy Dr. XXX and XXX are with their jobs and working with birds and nature, I have definitely gained interest in assuming their role when choosing a career path.”

From the entomology workshop, affective themed responses included feeling comfortable, open, or inclined to pursue a career in science education. One response elaborated on workshop effect: “[I will feel more] comfortable with pursuing a career as an educator because even though I was not labeled as a teacher I helped my fellow scientists out with things they did not know”.

Two 2018 workshop series responses had career orientation themes, though both were negative regarding education as a future career. One stated “I am not sure yet that I would want to be a teacher as a full time job.” Another was more uncertain saying “I’ve considered an educational career before, and it’s not off the table, but it’s not quite what I want to do when I’m older.”

One response included the future participation theme stating “I would love to volunteer at the Smithsonian.”

Many of the responses with interpersonal themes were in conjunction with affect and cognitive themes. Often the interpersonal themes emerged as reasoning to the cognitive or affective changes, explaining that the workshop allowed them opportunities to communicate or educate others. Some examples included; “[I will feel more] enthusiastic being able to share this incredible knowledge with others;” “[I will feel more] inclined to share my passion of such topics with others in hopes of some of them realizing how great it is;” and “[I will feel more] interested in helping others learn about natural sciences.”. From the entomology workshop, more than almost a third of respondents reported effect involving interpersonal themes, although they were often connected to the affective and cognitive reasons such as; “[I will feel more...] that I can teach science to others, whether it be young kids or aspiring scientists”; “[I will feel more...] likely to educate those around me”; or “[I will feel more...] [like] I would want to share my great experience”.

Career in a Museum

Of the 86 2018 workshop series respondents responses, 41 (48%) perceived at least some workshop effect on how they feel about pursuing a career in a museum; 39% rated the effect as moderate or high. Of the 17 2019 entomology workshop responses, 13 (77%) perceived at least some workshop effect; 61% rated the effect as moderate or high.

Most responses with cognitive themes indicated being interested in or aware of career opportunities in museums’. Two responses specifically referenced the novelty of considering a museum career: “[I will feel more] interest in working at a museum, although it’s not a career path I considered before;” and “[I will feel more] interested as I hadn’t thought about it before but I saw it could also be fun.” Another response mentioned that working behind the scenes at the museum helped them understand what a museum career might look like. From the entomology workshop the two responses with cognitive themes indicated being interested in or intrigued by career opportunities in museums. The first stated, “[I will feel more...] intrigued because I learned about the opportunities you have as a scientist at the Smithsonian”

Affective-themed responses included “ambitious,” “excited,” and “comfortable” in reference to working in a museum setting. One response explained: “[I will feel more] inspired to see what programs and education opportunities museums have to offer.” Another response stated: “[I will feel more] wishful that I can come back to a museum not as a visitor but a staff member.” A few career themed responses indicated the likelihood that they would pursue a career in a museum. One response simply said, “a career in a museum could be for me”. From the entomology workshop, affective-themed responses included “inspired,” “excited,” and “willing” in reference to working in a museum setting. One response explained: “[I will feel more...] comfortable in that environment.” Another response stated: “[I will feel more...] ready to pursue a career in a museum” and another stated; “[I will feel more...] inspired to seek out the opportunities that museums provide”.

Many cognitive and affective themed responses also referenced interpersonal themes. Some examples include:

“[I will feel more] excited about spending time in a museum and educating others;”

“[I will feel more...] familiar with the ins and outs of working at the museum like showing people around or answering questions anyone might have;”

“[I will feel more...] willing to work in a place where I could teach others and communicate with peers in other fields of science.”

From the entomology workshop, a few career themed responses were more negative in nature stating; “[I will feel more...] that careers in museums are unclear”. The other included interest in future participation but uncertainty around a career in museums stating “I think that this workshop has inspired me to want to volunteer at museums more, but I am not sure I have a large interest in pursuing a career in museums”.

Interpersonal and utility themes were less common. The utility themes response included feeling “ready to apply for careers in museums”.

One response mentioned several themes and described museum career interest because “I will have the chance to go places to obtain data and be able to lead workshops to students that are interested in my area/career.”

Effect on Science Identity

In both sessions, very little change in students’ science identity occurred from before ($M=8.2$) to after ($M=8.3$) the workshop ($paired\ t=(-.56, df=14, p=.58)$). Within individual items, after adjusting for multiple comparisons, there were no significant pre- to post-program differences.

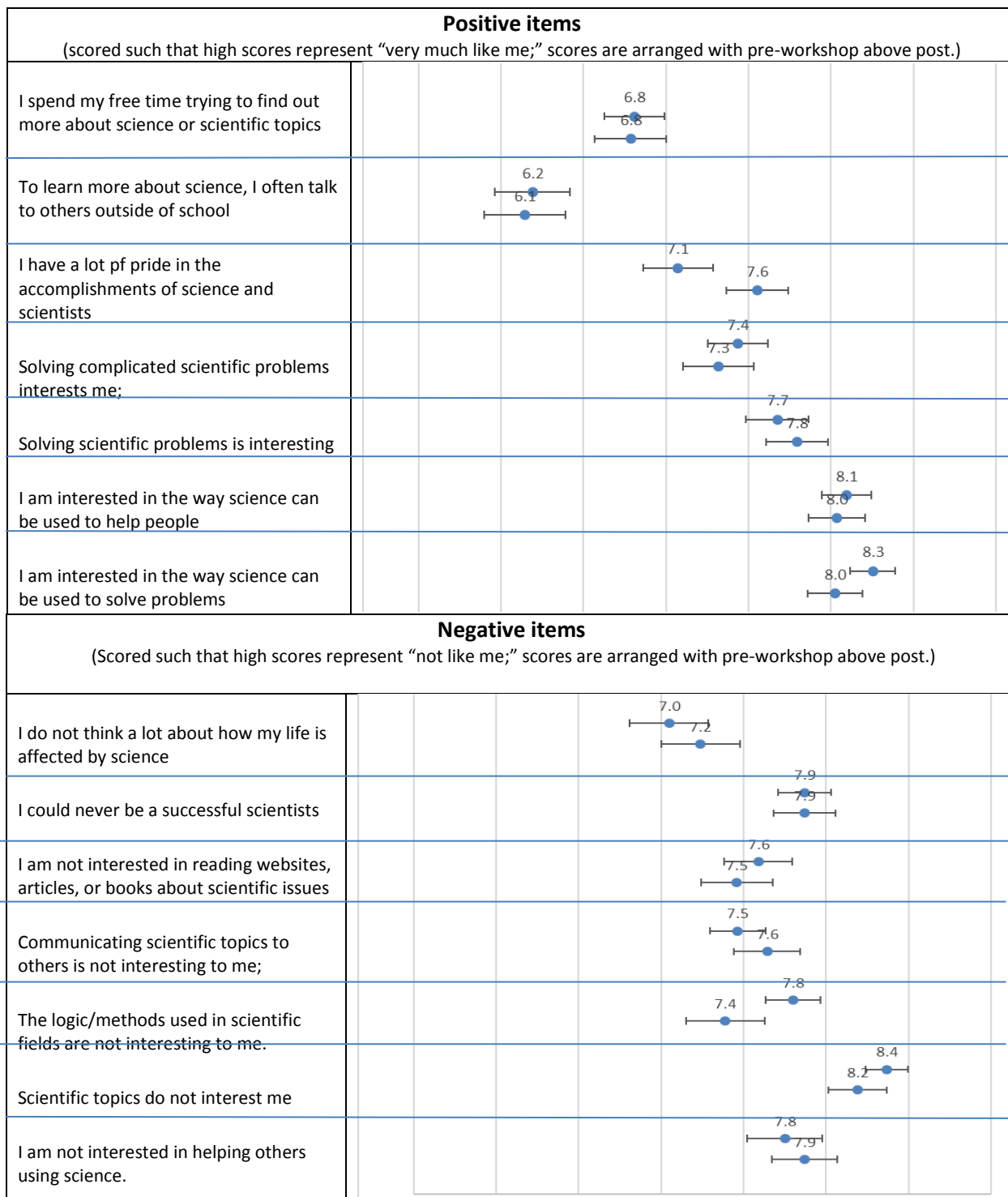


Figure 55. Means and confidence intervals for pre- and post-2018 workshop series identity items.

Effect on Natural History Interest

To understand the workshop effect on natural history, we divided the workshop population into three groups (low, medium, and high) based on their pre-workshop responses to questions about their interest in pursuing a Natural History topic as an academic major. We then analyzed how members of each group perceived how the workshop affected this interest.

As illustrated in Figure 57, participants entered the program with high intention to pursue natural history in college often left with high perceived effect of the workshop on their intention. Based on qualitative explanations of those effects, all were in a positive direction, i.e. enhanced intention. The workshop did not have as strong of an effect on the participants who reported medium or low intention prior to the workshop

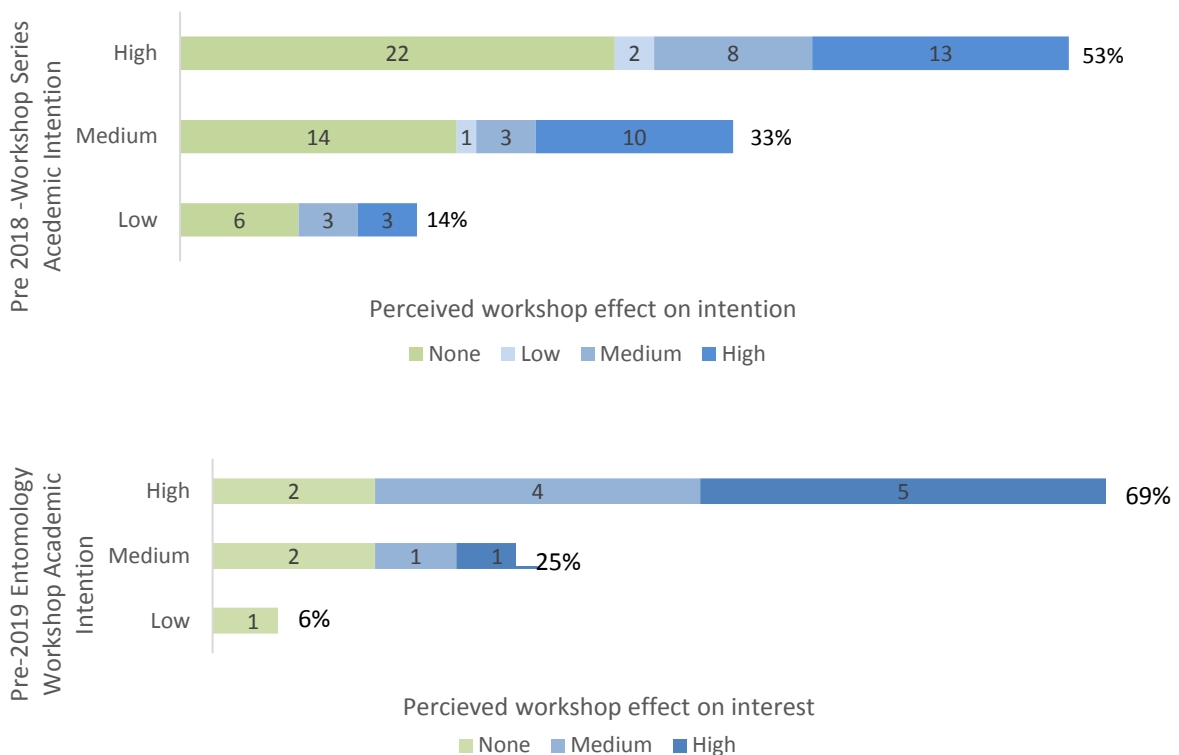


Figure 56. Effect of the workshops on interest to pursue a natural history college major by pre-program interest.

Q3. Community Collaborative Outreach Efforts

What We Learned

Necessity for better communication about current programming and application, and selection, and support processes. The community collaborator spoke about the lack of communication from NMNH regarding their youth programs including being relatively unaware of the opportunities at NMNH as well as the relationship between NMNH and her organization. The community collaborator also was unaware of NMNH transportation options, alternatives to online application processes, and programming available on weekends and PD days. In response, NMNH youth programming staff clarified the opportunities and application and selection processes and identified most effective/appropriate persons for contact.

Recommendation: establish a clear and effective communication system for use as NMNH expands its community collaborator network. Annually identify points of contact at each organization and build one-on-one in-person relationships. An effective system would include both clear messaging and follow-up to elicit (1) if messages have been accurately conveyed, and (2) how well programming and messaging are meeting target population needs.

How We Know

A three step process with feedback from two sources led to the conclusions listed above. First, as reported below, we summarized and analyzed responses from the community collaborator (section below titled “Initial Summaries of per-Question responses from Community Collaborator”). Second, we summarized the findings and provided recommendations. In response, the staff addressed the original summary with communication clarification and programming changes. Staff response appear below the original summary in the section titled

1. Initial Summaries of per Question Responses from Community Collaborator

Q1. Describe what you know of the NMNH youth programs and how they function (or fail to function) as a resource to the youth in your program. In what ways do you understand NMNH youth programs to be a resource to the youth in your program]?

The collaborator expressed that the partnership is very limited. It began 5 years ago when NMNH reached out to increase the diversity of the YES! program. The youth from the program who applied would be accepted and always did well. However, as turnover at NMNH has occurred the communication has gone away and now their youth are not getting accepted and she does not know why. She mentioned that she would love to have NMNH bring workshops to them due to the infeasibility of getting the youth to the museum before it closes on regular days.

Q2. In your program, about how many students each year would you say would be interested in/could benefit from NMNH youth programs? Does the number of those who would benefit differ from the number of those who are interested? If so, what makes the difference? Kind of person or list?

Every year there are different youth in the program and about 4 or 5 of them apply every year. She is mostly unsure why the youth are no longer being accepted. She would prefer having someone from the programs come in and speak about them since she was not informed on how to talk about them. Programs that include getting paid, like YES!, and are more job like would really encourage the youth she works with. She thinks that if NMNH could bring workshops or scientists in to speak with the youth it would encourage them and expose them to new things.

Q3. What conditions make it difficult/over-challenging/uninteresting for youth to consider participating in NMNH programs? applying for them?

The collaborator listed the lack of knowledge about programming outside of YES! internships as a large barrier. She mentioned that there may be some competition between her program and NMNH's after school program citing that they help students apply to college and they prevent them getting in trouble after school but they don't have the same education focus as NMNH does.

Q4. What strategies could the program use to best appeal to or reach out to the youth in your program? Prompts: send speakers? Help with applications?

Speakers coming to the program would be very beneficial for the youth. The collaborator also suggested that NMNH look into programming on days when the students have off for teacher work days when her program would be able to bring the students to the museum. Q5. What could NMNH do to help you know the program well enough to talk about and promote it?

It is preferred if NMNH would come and educate the leaders and youth about their programming. The collaborator explained that the only reason they knew about YES! was that several years ago the CEO of their organization's daughter went through the program. Then the program became less restrictive and looked at more than grades, which the collaborator mentioned disadvantaged their youth while they need the opportunities the most. She mentioned that the DC museums offer good programming but that needs to be brought into the communities where the kids are.

Q6. What other similar opportunities are available to the youth in your program? How do you choose which to promote and for what reasons?

The collaborator remembered there being another program for teens at a different museum but could not recall what it was. She said that it had the same problem that NMNH programs do in that the museums are closed by the time they could get there. During the week, she explained, it would

be helpful if the museums could come out and teach the youth and give them experiences through workshops.

The collaborator also spoke about how the people with money and better education can look for these kinds of opportunities for their kids but the youth they serve have parents who work multiple jobs and may not know how or have time to look for these kinds of opportunities for their kids.

Q7. In what ways would you use the term "community partner" to describe your organization's relationship with the NMNH youth programs?

The collaborator said that the partnership extends to solely what was described in previous questions. She explained that when NMNH needs a grant they are contacted to write about diversity but she rarely hears anything else after that and doesn't know if those grants ever go anywhere. She continued stating that the partnership has greatly diminished as staffing changes and that it feels much more like a person to person relationships than between two institutions.

Q8. NMNH is looking to reach the youth in your programs who can benefit from NMNH internships, research opportunities, and volunteering. More than just seeking referrals, NMNH is wanting to be an active partner with you in providing quality opportunities for these young people. Youth program staff are wanting to understand ways they can function as an authentic collaborative partner with you. Can you think of ways they might work with you or your organization to best function as a resource? Can you think of other collaborative roles they could or should assume?

The collaborator explained that several of the students in her program participate in a DC-sponsored 6-week long summer jobs program through which students are paid salaries. She wanted to know if this could be opened with NMNH as a museum internship experience with more people. She explained that this would be good exposure and experiences because they will never take kids out of school for any programming, they often do not have parents who can take them to programming.

She continued, that NMNH should take more advantage of the work days at schools as ways to reach kids without taking them out of school. Internships are also not viable during the school year since kids are in school. Finally, evening programs are not tenable since the youth would be taking the metro and other public transportation which is not safe for them in the evenings since their parents cannot drop them off or pick them up.

In summary she listed four takeaways that she hopes NMNH takes to heart:

1. Bring workshops to the youth
2. Give more places for kids to work in the summer

3. Take advantage of the days off school
4. Open YES! again/more and have someone come talk about it to get the kids excited and help them apply so it's not totally focused on grades, they have smart kids

Q9. What else would you like to add? Is there anything else you'd like the museum staff or museum educators to know?

She ended saying that NMNH needs to know that they are only open when kids are in school.

2. Initial Conclusions based on Per Question Responses.

Necessity for better communication about current programming. The community collaborator spoke about the lack of communication from NMNH regarding their youth programs including being relatively unaware of the opportunities at NMNH as well as the relationship between NMNH and her organization. She was concerned that fewer of her students have been accepted into the YES! program and believed that change may be due to inconsistent communication with NMNH and new acceptance criteria less sensitive to the population she serves.

A need to provide programming that fits with youth's schedules. The collaborator also wanted to make sure the museum staff knew the impossibility of her students attending NMNH in a timely manner. NMNH program hours allow have insufficient time for students to go from school to the OST facility and then to the museum before it closes. She made several suggestions including (1) bringing small scale programming or just the scientists themselves to the facility to help expose the youth and (2) creating opportunities for participation in NMNH programming on days when schools-is out due to teacher training or conferences.

Transportation and application logistics could better accommodate student needs. Finally, the collaborator wanted NMNH to be more aware that, for most students, the logistics of NMNH programming precludes attendance. Specifically, these barriers involve transportation for events and online applications.

True partnership would involve collaboration and communication around project development, grant application, and especially follow-up.

Recommendations

Provide community partners with easily accessible and complete information about available youth opportunities, necessary qualifications (if any), and ways participation could benefit youth both academically and in the working world especially in-person.

Help youth leaders understand all the youth programming opportunities across the Smithsonian.

Provide community partners with transparent understanding of the YES! and Q?rius application and selection processes.

Clarify how NMNH programming and intended outcomes differ from and support intended outcomes of out-of-school time programs.

Consider creative ways of working collaboratively with after-school programs so that the NMNH experiences strengthen these programs without competing with them.

Consider working with these programs to create youth opportunities on schools-out days when the programs have the time to bring youth to NMNH.

Consider providing programming at the youth center sites rather than expecting young people to come to NMNH and take other transportation concerns into account with on-site events (i.e. public transportation).

Consider including community partners as active and funded partners in grant proposals.

Explore the potential of becoming an employment site for the DC City teen jobs program.

3. Staff Feedback and Programmatic Responses to Initial Findings.

Recognizing the vital importance of our community partners, NMNH wanted to reengage and revitalize past relationships for our 2019 programming year. Receiving the feedback from the evaluation call was immensely helpful. We realized that there was great deal of confusion and misinformation about our programming and as a result we were able to take the following steps to correct misconceptions:

1. Issue one-A misunderstanding of our selection criteria and application process.-We set up a call with the employee interviewed to clear up confusion about the programming regarding structure, applications, and selection. We were also connected with the best coordinator to work with moving forward for site visits.
2. Issue two-A misunderstanding of the suite of our offerings and when they ran.-During the call we went through our offering and their schedules. Afterwards, we advertised and recruited participants for our Natural History Investigation that was scheduled for DC Public School Professional Development days.
3. Issue three-A perception that we were accepting less of their participants.-We actually saw a severe decrease in their applicants since in person recruitment was cut and we had been accepted those that did apply. In person recruitment for Q?Crew and YES! which resulted in an increase in applicants.
4. Issue four-A lack of transparency in the application process- After applicant selection was made we sent a follow-up email to the program coordinators letting them know who was selected and why to increase transparency.



Figure 57. Staff feedback to initial community collaborative outreach summary.

Conclusion

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Appendices

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Appendix A. The Q?rius Science Learning Ecosystem Logic Model

PROJECT GOALS:

- Build a “Staircase of Academic Opportunity” at the museum (as called for in the *NMNH Five-Year Strategic Plan*) that mentors, trains, inspires, grows, and diversifies the next generation of natural history scientists and museum professionals by increasing the quality and quantity of opportunities for youth from populations underrepresented in STEM careers to engage in science through access to and engagement with Smithsonian scientists, research, and collections;
- Increase the number of young people who are confidently, actively, and regularly involved in conversations about science with each other, diverse audiences, and the SI Museum community;
- Increase the number of young people who understand how to establish and use professional networks and mentors; and
- Build upon strong foundational programs, combining resources in order to be efficient, and taking full advantage of the Smithsonian’s unique assets and resources to strengthen an infrastructure at NMNH that can serve greater numbers of young people in the future with high-quality youth programming.

RESOURCES/ INPUTS	AUDIENCE	ACTIVITIES	OUTPUTS	SHORT & MID-TERM OUTCOMES	LONG-TERM OUTCOMES (IMPACT)
<i>In order to accomplish our set of activities we will need the following:</i>	<i>In order to measure change and/or impact we have determined the following needs of the target audience:</i>	<i>In order to address our problem or asset we will accomplish the following activities:</i>	<i>We expect that once accomplished these activities will produce the evidence:</i>	<i>We expect that if accomplished these activities will lead to the following changes in 1-3 & 4-6 years:</i>	<i>We expect that, if accomplished, these activities will lead to the following changes in 7-10 years:</i>
<p>Smithsonian Inputs:</p> <ul style="list-style-type: none"> • Experience with youth programs: YES!, Q?Crew, EYES, SYSTEMIC, ARTLAB+ partnership, Youth Advisory Board • SI Office of International Relations <p>NMNH Inputs:</p> <ul style="list-style-type: none"> • Education and Outreach Staff • NMNH Science Staff • NMNH Collections, Technology and Digital Assets • Q?Method Experience Design Process 	<p>9th - 12th grade DC-area youth underrepresented in STEM:</p> <ul style="list-style-type: none"> • Lack diversity of opportunities to pursue interest in science in out-of-school settings • Lack opportunity to interact with near-peer and peer role models around scientific topics • Lack opportunity to play leadership role in communicating to the public about science and nature • Lack of access to and engagement with scientists, content experts, and technology 	<ul style="list-style-type: none"> • Recruit, interview and select youth • Develop and refine Q?rius Academy course catalog and implementation plan • Coordinate and implement Q?rius Youth Academy • Implement YES! Research Internship program • Train, assess and coach new Q?Crew on facilitation and communication skills • Implement refresher training for returning Q?Crew volunteers 	<ul style="list-style-type: none"> • 100 high school students trained in science research, technology and communication (YES 1.0 and Q?Crew) • 4 high school students trained in advanced research techniques (YES 2.0) • 6 Q?Crew Captains in a paid, lead role in the museum • 30 New to Q teens exposed to NMNH and Smithsonian science • Youth-serving professionals trained in specific Q?rius Academy Courses • 100 participants of mini-conference 	<p>Student Outcomes</p> <ul style="list-style-type: none"> • Enhanced identity as people who know about, use, and communicate effectively about science; • Increased understanding of science content based on research being conducted at NMNH and its relevance to important science topics that affect their world; • Increased skill and confidence in communicating complex science topics to diverse audiences; • Increased understanding of natural history and 	<p>Student Outcomes</p> <ul style="list-style-type: none"> • Increased numbers of science-literate citizens who are able to effectively understand and communicate about important science topics including current environmental and social issues • Increase in the number of students from underrepresented communities pursuing science degrees in colleges and universities. <p>Outcomes</p> <ul style="list-style-type: none"> • A pathway towards paid employment at SI • Exhibits, activities and outreach that are more relevant to our visitors and therefore more effective • Increased relationships with the local community

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<p>Community Partners Inputs:</p> <ul style="list-style-type: none"> Recruitment pool of target audience <p>External Inputs:</p> <ul style="list-style-type: none"> Youth Program Assistant Q?rius Assistant Q?rius A/V Technician External educators and experts for Master Classes <p>Technology:</p> <ul style="list-style-type: none"> Scanning Electron Microscope 	<ul style="list-style-type: none"> Lack opportunity to communicate and collaborate with like-minded peers about STEM research and relevance Lack community of peers with similar science interests 	<ul style="list-style-type: none"> Hire, train and deploy Q?Crew captains to mentor Q?Crew and assist in Q?rius projects Design, promote and implement Museum Immersion Experience for community teens Invite community teens to participate in Q?rius Academy offerings Implement national outreach through professional conferences Develop and pilot Q?rius Academy for Professionals 	<p>gaining and sharing best practices about supporting the next generation of diverse scientists</p>	<p>life on Earth in the past, present, and future, and its relevance to their lives</p> <ul style="list-style-type: none"> Increased awareness of a broad range of science careers and enhanced view of science as a viable career track Increase in transferable workforce skills (presenting, writing, personal responsibility, communication skills, peer-to-peer mentoring, near peer teaching) Increased skill in using scientific equipment and technology to communicate about NMNH science topics Increased confidence in applying communication skills to a diversity of audiences and settings. 	
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Appendix B. Q1. Q?Crew, Captains, and YES! 2018 Pre-Program Questionnaire

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Deborah Wasseman, Ph.D.; Senior 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.

Default Question Block

Welcome to the NMNH Youth Program Questionnaire!

Before you launch into this exciting time of NMNH discovery and learning, we'd like to know a bit more about who you are and about your interest in science both now and for your future. This questionnaire will help us get to know you better, learn how we can meet your needs and how we might make future NMNH youth programs work well for other teens.

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 this study. If you agree to participate, you will answer some questions now and then some more at the end of your internship. This pre-internship questionnaire should take you about 10 minutes to complete.

We do not anticipate any risks to you by participating in this study. The only anticipated benefits are that your feedback may help strengthen NMNH youth programs in the future. 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:

We begin by asking you some questions about your plans. Thinking about the future, are you planning to go to college?

- Yes
- No

What academic subjects do you think you might pursue in college?

How much do you expect these subjects to involve your science interest?

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

Right now, if you had to choose, what do you expect your career will be?

How much do you expect this career will involve your science interest?

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

These next questions are about you and science. The Venn diagrams below represent you (blue) and science (green). Please select the image that best represents your relationship to science.



Please respond to each statement on the scale from 1 to 9 where "9" indicates the statement describes you extremely well and "1" that it describes you not at all.

	Describes me extremely well 9	8	7	6	Describes me moderately well 5	4	3	2	Does not describe me well at all 1
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"/>

	Describes me extremely well 9	8	7	6	Describes me moderately well 5	4	3	2	Does not describe me well at all 1
I do not 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"/>
To learn more about science, I often talk to others outside of school.	<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"/>
I could never 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"/>
	Describes me extremely well 9	8	7	6	Describes me moderately well 5	4	3	2	Does not describe me well at all 1
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"/>
Click to write Statement 15	<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 not 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"/>
Communicating scientific topics to others is not 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"/>
The logic/methods used in scientific fields are not 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"/>

	Describes me extremely well 9	8	7	6	Describes me moderately well 5	4	3	2	Does not describe me well at all 1
Describes me extremely well 9	8	7	6	Describes me moderately well 5	4	3	2	Does not describe me well at all 1	
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"/>
Scientific topics do not 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"/>
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"/>
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"/>
I am not interested in helping others using 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"/>

The statements below ask you to think about the science process and the utility of thinking creatively. For each, please mark how much you agree or disagree with each statement.

Thinking creatively is very useful for . . .

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
1 . . . forming scientific questions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2 . . . asking questions that can be answered by collecting data.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
3 . . . designing scientific procedures to answer a question.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4 . . . communicating a scientific procedure to others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5 . . . recording data accurately.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6 . . . creating a graph for presentation to others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7 . . . creating a display to communicate scientific data and observations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8 . . . analyzing the results of a scientific investigation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9 . . . choosing and using science terms to share scientific results.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10 . . . for using scientific models to explain results.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11 . . . for answering a scientific question.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please re-enter your password to finish.

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Appendix C. Q1. Q?Crew and YES! 2018 Post-Program Questionnaire

Welcome to the NMNH 2018 Youth Programs Study!

Thanks so much for participating. The purpose of this study is to help us learn more about YES! interns, how we can meet your needs and how we might make the YES! experience work well for future YES! 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 NMNH youth programs in the future. 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 614-829-3123.

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.

Outcome#1. Interest in Science

This section of questions is about your YES! experience and how it has 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). Please select the image that best represents your relationship to science.



Please respond to each statement on the scale from 1 to 9 where "1" indicates the statement describes you not at all and "9" that it describes you extremely well.

	Does not describe me well at all	1	2	3	4	Describes me moderately well	5	6	7	8	Describes me extremely well	9
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"/>	<input type="radio"/>	<input type="radio"/>
I do not 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"/>	<input type="radio"/>	<input type="radio"/>
To learn more about science, I often talk to others outside of school.	<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"/>	<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"/>	<input type="radio"/>	<input type="radio"/>
I could never 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"/>	<input type="radio"/>	<input type="radio"/>

	1	2	3	4	5	6	7	8	9
	Does not describe me well at all				Describes me moderately well				Describes me extremely well
	1	2	3	4	5	6	7	8	9
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"/>
I am not 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"/>
Communicating scientific topics to others is not 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"/>
The logic/methods used in scientific fields are not 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"/>
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"/>
	Does not describe me well at all				Describes me moderately well				Describes me extremely well
	1	2	3	4	5	6	7	8	9
Scientific topics do not 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"/>
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"/>
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"/>

	Does not describe me well at all	2	3	4	Describes me moderately well	6	7	8	Describes me extremely well
	1	2	3	4	5	6	7	8	9
I am not interested in helping others using 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"/>

We are interested in how your YES! experience has affected your interest in science.

Please respond to each statement in three ways:

1. Before you were a YES! intern, how much would you have agreed or disagreed with the statement?
2. Now, how much do you agree or disagree?
3. If you have changed, how much did your YES! experience contribute to your change?

	BEFORE I was a YES! intern, I would have said I . . .	NOW, I . . .	How much was the change due to your YES! internship?
I would like to have a career in science.	<input type="text"/>	<input type="text"/>	<input type="text"/>
My family is interested in the science courses I take.	<input type="text"/>	<input type="text"/>	<input type="text"/>
I would enjoy a career in science.	<input type="text"/>	<input type="text"/>	<input type="text"/>
My family has encouraged me to study science.	<input type="text"/>	<input type="text"/>	<input type="text"/>
I will make it into a good college and major in an area needed for a career in science.	<input type="text"/>	<input type="text"/>	<input type="text"/>
I will graduate with a college degree in a major area needed for a career in science.	<input type="text"/>	<input type="text"/>	<input type="text"/>

	BEFORE I was a YES! intern, I would have said I . . .	NOW, I . . .	How much was the change due to your YES! internship?
I will have a successful professional career and make substantial scientific contributions.	<input type="text"/>	<input type="text"/>	<input type="text"/>
I will get a job in a science-related area.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Some day when I tell others about my career, they will respect me for doing scientific work.	<input type="text"/>	<input type="text"/>	<input type="text"/>

Thinking about the future, are you planning to go to college?

- Yes
 No

What subjects are you interested in studying in college?

How much has your YES! experience affected what you want to study in college?

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

Right now, if you had to choose, what do you expect your career will be?

How much has your YES! experience affected your career expectations?

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

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 (or continue to do).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . most of the things I did I felt like "I have 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 feel confident that I could do things well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
. . . I feel 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"/>

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
... 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 others 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.

We are interested in how you think your YES! experience has affected the way you can communicate about science to others:

1. Before you were a YES! intern how strong were your skills in each area?
2. Now, how strong are your skills? (Leave the answer blank if there has been no change)
3. If your skill level changed, how much do you contribute the change to your YES! experience?

	BEFORE I was a YES! intern, my ability was ...	NOW, my ability is...	How much was the change due to your YES! internship?
Explaining scientific concepts with everyday related examples.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using maps, graphs, charts, tables to understand a scientific explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using maps, graphs, charts, and tables to help visitors understand my explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Linking multiple maps, graphs, charts, or tables with each other to help visitors understand my explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Changing scientific language into everyday language	<input type="text"/>	<input type="text"/>	<input type="text"/>
Giving concise answers to questions about scientific terms or definitions.	<input type="text"/>	<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"/>	<input type="text"/>
Asking a visitor if she or he has understood my explanations.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Hearing and using in my explanation the terms my listener is using.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Asking the visitors what they already know before I help them learn more.	<input type="text"/>	<input type="text"/>	<input type="text"/>

	BEFORE I was a YES! intern, my ability was . . .	NOW, my ability is...	How much was the change due to your YES! internship?
Adjusting my explanation to what the visitor already knows.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using questions to help visitors discover things.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Linking multiple collection objects to help visitors understand my explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using multiple collection objects to understand a scientific explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>

Outcome #3. Science Content

In this section, there is only one question!

In what ways has your YES! experience enhanced your **science content knowledge**?

In your answer, please include the area of science content or the science topic your YES! experience has helped you learn most. Please be specific about what you have learned.

This section is about useful skills. It will take you about 20 minutes to complete.

We are interested in how you think your YES! experience has affected your **critical thinking and problem solving skills**. Some of these ways of thinking and solving problems appear in the list below.

Please respond to each in three ways:

1. Before you were a YES! intern, how strong were your skills in each area?
2. Now, how strong are your skills?
3. If your skill level changed, how much do you think your YES! experience contributed to the change?

	BEFORE I was a YES! intern, my ability was . . .	NOW my ability is...	How much was the change due to YES!?
Finding strategies for remembering information.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Communicating my ideas or what I have learned.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Finding my own examples that show things I have learned.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Finding the important points of an idea.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Explaining how important points of an idea fit together.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Finding similarities and differences between ideas.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Playing with ideas.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Organizing my ideas in a logical way	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using creativity in my school work	<input type="text"/>	<input type="text"/>	<input type="text"/>
Applying what I learn to solving problems	<input type="text"/>	<input type="text"/>	<input type="text"/>
Looking for new ideas for how to go about solving problems.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Determining if a tool will be useful for accomplishing a specific task.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Predicting how well I will do a specific task.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Being more sure of what my strengths and weaknesses are.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Having confidence to try new things.	<input type="text"/>	<input type="text"/>	<input type="text"/>

Outcome #4. 21st Century Skills

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

Please tell us how much being a YES! intern has contributed to your leadership skills:

Please respond to each statement in three ways:

1. How do you rate your skill now?
2. How do you rate your skill just before your YES! internship?
3. If you have changed, how much did your YES! experience contribute to your change?

	BEFORE I was a YES! intern...	NOW I...	How much did your YES! internship experience contribute to the change?
Being able to interact with adults.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Ability to think about how my actions affect others.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Ability to tell other people about what I've learned.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Ability to work as part of a team or group.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Ability to share my thoughts and ideas with others.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Ability to be patient.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Being confident to try new things.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Being able to accept responsibility.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Being willing to take on a leadership role.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Being willing to take care of the environment.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Seeing myself as part of nature.	<input type="text"/>	<input type="text"/>	<input type="text"/>

The statements below ask you to think about the science process and the utility of thinking creatively.

For each, please mark how much you agree or disagree with each statement.

Thinking creatively is very useful for . . .

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
1. . . . forming scientific questions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. . . . asking questions that can be answered by collecting data.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. . . . designing scientific procedures to answer a question.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. . . . communicating a scientific procedure to others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
5. . . . recording data accurately.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. . . . creating a graph for presentation to others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. . . . creating a display to communicate scientific data and observations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. . . . analyzing the results of a scientific investigation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
9. . . . choosing and using science terms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

to share scientific results.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
10. . . . using scientific models to explain results.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. . . . answering a scientific question.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q?Crew Contribution

This question wraps it all up. Considering all the ways you've changed and what you have learned as a YES! intern, please rate the relative percentage each of the following YES! experiences contributed to your learning. (Your numbers need to add up to 100).

	No contribution at all											totally
	0	10	20	30	40	50	60	70	80	90	100	
Informal talking sessions with scientists and college students	<input type="text"/>											0
Science communication training	<input type="text"/>											0
Intern is in sessions	<input type="text"/>											0
College Prep Workshops	<input type="text"/>											0
Preparing and delivering your YES! TED-style presentations	<input type="text"/>											0
Internship with your science mentor	<input type="text"/>											0
Behind-the-scene tours and field trips	<input type="text"/>											0

Community Day/Teen Takeover	<input type="text"/>											0
Interactions with museum education staff	<input type="text"/>											0
Interactions with fellow YES! interns	<input type="text"/>											0
Total:												0

Please re-enter your password to finish.

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Appendix D. Q1. Q?Crew Captain Post-Program Questionnaire

Welcome to the NMNH 2018 Youth Programs Study!

Thanks so much for participating. The purpose of this study is to help us learn more about Q?Crew captains, how we can meet your needs and how we might make the Q?Crew experience work well for future Q?Crew captains.

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 NMNH youth programs in the future. 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.

Outcome#1. Interest in Science

This section of questions is about your Q?Crew experience and how it has 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) . Please select the image that best represents your relationship to science.



We are interested in how your Q?Crew experience has affected your interest in science.

Please respond to each statement in three ways:

1. Before you were a Q?Crew captain, how much would you have agreed or disagreed with the statement?
2. Now, how much do you agree or disagree?
3. If you have changed, how much did your Q?Crew experience contribute to your change?

	BEFORE I was a Q?Crew volunteer, I would have said I . . .	NOW, I . . .	Q?Crew CONTRIBUTION to the change (Leave this space blank if there was no change)
I would like to have a career in science.	<input type="text"/>	<input type="text"/>	<input type="text"/>
My family is interested in the science courses I take.	<input type="text"/>	<input type="text"/>	<input type="text"/>
I would enjoy a career in science.	<input type="text"/>	<input type="text"/>	<input type="text"/>
My family has encouraged me to study science.	<input type="text"/>	<input type="text"/>	<input type="text"/>
I will make it into a good college and major in an area needed for a career in science.	<input type="text"/>	<input type="text"/>	<input type="text"/>

	BEFORE I was a Q?Crew volunteer, I would have said I ...	NOW, I ...	Q?Crew CONTRIBUTION to the change (Leave this space blank if there was no change)
I will graduate with a college degree in a major area needed for a career in science.			
I will have a successful professional career and make substantial scientific contributions.			
I will get a job in a science-related area.			
Some day when I tell others about my career, they will respect me for doing scientific work.			

Thinking about the future, are you planning to go to college?

- Yes
- No

What subjects are you interested in studying in college?

How much has your Q?Crew experience affected what you want to study in college?

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

Right now, if you had to choose, what do you expect your career will be?

How much has your Q?Crew experience affected your career expectations?

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

Now we'd like to know a bit about your experience as a Q?Crew volunteer. Please respond to the following statements:

In my experience as a Q?Crew captain, 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 (or continue to do).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... most of the things I did I felt like "I have 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 feel confident that I could do things well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... I feel serious doubts about whether I could do things well.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Outcome #2. Communication

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

We are interested in how you think your Q?Crew experience has affected the way you can communicate about science to others:

1. Before you were a Q?Crew captain how strong were your skills in each area?
2. Now, how strong are your skills? (Leave the answer blank if there has been no change)
3. If your skill level changed, how much do you contribute the change to your Q?Crew experience?

	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 others 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"/>

	BEFORE I was a Q?Crew captain, my ability was ...	NOW my ability is ...	Q?crew CONTRIBUTION to the change (Leave this space blank if there was no change)
Explaining scientific concepts with everyday related examples.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using maps, graphs, charts, tables to understand a scientific explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using maps, graphs, charts, and tables to help visitors understand my explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Linking multiple maps, graphs, charts, or tables with each other to help visitors understand my explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Changing scientific language into everyday language	<input type="text"/>	<input type="text"/>	<input type="text"/>
Giving concise answers to questions about scientific terms or definitions.	<input type="text"/>	<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"/>	<input type="text"/>
Asking a visitor if she or he has understood my explanations.	<input type="text"/>	<input type="text"/>	<input type="text"/>

	BEFORE I was a Q?Crew captain, my ability was . . .	NOW my ability is . . .	Q?crew CONTRIBUTION to the change (Leave this space blank if there was no change)
Hearing and using in my explanation the terms my listener is using.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Asking the visitors what they already know before I help them learn more.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Adjusting my explanation to what the visitor already knows.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using questions to help visitors discover things.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using multiple collection objects to understand a scientific explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Linking multiple collection objects to help visitors understand my explanation.	<input type="text"/>	<input type="text"/>	<input type="text"/>

Outcome #3. Science Content

In this section, there is only one question!

In what ways has your Q?crew Experience enhanced your **science content knowledge**?

In your answer, please include the area of science content or the science topic your Q? crew experience has helped you learn most. Please be specific about what you have learned.

This section is about useful skills. It will take you about 20 minutes to complete.

We are interested in how you think your Q?Crew experience has affected your **critical thinking and problem solving skills**. Some of these ways of thinking and solving problems appear in the list below.

Please respond to each in three ways:

1. Before you were a Q?crew captain, how strong were your skills in each area?
2. Now, how strong are your skills? (Leave the answer blank if there has been no change)
3. If your skill level changed, how much do you think your Q?crew experience contributed to the change?

	BEFORE I was a Q?crew captain, my ability was . . .	NOW my ability is (Leave this space blank if there has been no change)	Q?crew CONTRIBUTION to the change (Leave this space blank if there was no change)
Finding strategies for remembering information.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Communicating my ideas or what I have learned.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Finding my own examples that show things I have learned.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Finding the important points of an idea.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Explaining how important points of an idea fit together.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Finding similarities and differences between ideas.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Playing with ideas.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Organizing my ideas in a logical way	<input type="text"/>	<input type="text"/>	<input type="text"/>
Using creativity in my school work	<input type="text"/>	<input type="text"/>	<input type="text"/>
Applying what I learn to solving problems	<input type="text"/>	<input type="text"/>	<input type="text"/>
Looking for new ideas for how to go about solving problems.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Determining if a tool will be useful for accomplishing a specific task.	<input type="text"/>	<input type="text"/>	<input type="text"/>

	BEFORE I was a Q?crew captain, my ability was . . .	NOW my ability is (Leave this space blank if there has been no change)	Q?crew CONTRIBUTION to the change (Leave this space blank if there was no change)
Predicting how well I will do a specific task.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Being more sure of what my strengths and weaknesses are.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Having confidence to try new things.	<input type="text"/>	<input type="text"/>	<input type="text"/>

Outcome #4. 21st Century Skills

This section is about Q?Crew and your personal development. It will take about five minutes to complete.

Please tell us how much being a Q?Crew captain has contributed to your personal development in the following areas:

	Not at all 1	2	3	4	5	6	A lot 7
Being able to interact with adults.	<input type="radio"/>	<input type="radio"/>	<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"/>	<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"/>	<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"/>	<input type="radio"/>	<input type="radio"/>
	Not at all 1	2	3	4	5	6	A lot 7
Ability to share my thoughts and ideas with others.	<input type="radio"/>	<input type="radio"/>	<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"/>	<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"/>	<input type="radio"/>	<input type="radio"/>

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	Not at all 1	2	3	4	5	6	A lot 7
Being able to accept responsibility.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Not at all 1	2	3	4	5	6	A lot 7
Being willing to take on a leadership role.	<input type="radio"/>	<input type="radio"/>	<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"/>	<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"/>	<input type="radio"/>	<input type="radio"/>

The statements below ask you to think about the science process and the utility of thinking creatively.

For each, please mark how much you agree or disagree with each statement.

Thinking creatively is very useful for . . .

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
1. . . . forming scientific questions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. . . . asking questions that can be answered by collecting data.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. . . . designing scientific procedures to answer a question.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. . . . communicating a scientific procedure to others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
5. . . . recording data accurately.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SMILSONIAN- NIVINI

Youth Programs

6. . . . creating a graph for presentation to others.	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. . . . creating a display to communicate scientific data and observations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. . . . analyzing the results of a scientific investigation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree
9. . . . choosing and using science terms to share scientific results.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. . . . using scientific models to explain results.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. . . . answering a scientific question.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q?Crew Contribution

This question wraps it all up. Considering all the ways you've changed and what you have learned as a Q?Crew captain, please rate the relative percentage each of the following Q?Crew experiences contributed to your learning. (Your numbers need to add up to 100).

	No contribution at all	totally
	0 10 20 30 40 50 60 70 80 90 100	
Visitor interactions during active volunteer time	<input type="text" value="0"/>	

Personal experience with museum exhibits	<input type="text" value="0"/>
--	--------------------------------

Bootcamp Week	<input type="text" value="No contribution at all"/>	<input type="text" value="totally"/>	<input type="text" value="0"/>
Q?rius Youth Leadership electives	<input type="text" value="0"/>		
Interactions with Q?Crew Captains	<input type="text" value="0"/>		
Pulse Checks	<input type="text" value="0"/>		
Interactions with other Q?crew volunteers	<input type="text" value="0"/>		
Interactions with museum staff	<input type="text" value="0"/>		
Interactions with adult volunteers	<input type="text" value="0"/>		
Total:	<input type="text" value="0"/>		

Please Re-enter your password to finish the survey. Thank you!

Appendix E. Teen Night Out Survey

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Smithsonian- NMNH

Youth Programs

What's next for you at NMNH?

Please select one of the following six options:

- 1. Contact me because I'm interested in participating in the Youth Academy workshop series.
- 2. Contact me because I'm interested in becoming a Q?Crew Volunteer;
- 3. Contact me because I'm interested in a YES! internship.
- 4. Contact me because I'm interested in either Q?Crew volunteering or a YES! internship or the Youth Academy series.
 My first choice is . . .
- 5. Contact me when you have another one of these parties.
- 6. Please don't contact me, I'll let you know if I'm ever interested in anything else here.

Thank you!

If you would like to enter a chance to win a \$100 VISA gift card please enter a **valid email address** below, for the gift card to be sent to. This email address will not be linked to your survey answers and will be used **ONLY** for the gift card drawing. You will be notified by email if you have won.

If you do not want to enter the drawing please click the "Next" arrow at the bottom of the page to submit your survey. Thank you!

Appendix F. Workshop Pre-Program Survey

Intro

Welcome to the NMNH Workshops!

The purpose of this questionnaire is to help us learn more about you, your interests, and your expectations.

For a detailed description of how we will be using the information you provide, click on this [link](#). Please read it over to help you decide if you would like to participate. This questionnaire should take you about 15 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 NMNH youth programs in the future. 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.; Senior Research Associate; Lifelong Learning Group: dwasserman@oosi.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: (616-421-0008).

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.

Q?rius Youth Academy Classes

These first questions are about your relationship to the National Museum of Natural History (NMNH) and its Q?rius youth programs.

For what reason(s) did you choose to participate in this workshop series?

Did you attend the Teen Night Out @ NMNH teen party?

- Yes
- No

How important was attending the teen party to your signing up for this workshop series?

- Extremely important
- Very important
- Moderately important
- Slightly important
- Not at all important

How interested are you in applying for either of the NMNH Leadership Programs?

	Extremely	Very	Moderately	Slightly	Not at all
Q?Crew Volunteer Program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Youth Engagement Through Science (YES!) Internship Program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How great is the possibility you will go to college and major in a subject related to natural history?

- Extremely high
- High
- Moderate
- Slight
- None at all

How great is the possibility you will pursue a career in a subject related to natural history?

- Extremely high
- High
- Moderate
- Slight
- None at all

This last set of questions is about you and science. Please respond to each statement on the scale from 1 to 9 where "1" indicates the statement describes you extremely well and "9" that it describes you not at all.

	Describes me extremely well	2	3	4	Describes me moderately well	6	7	8	Does not describe me well at all.
	1				5				9
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"/>
I do not 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"/>
To learn more about science, I often talk to others outside of school.	<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"/>

	Describes me extremely well	2	3	4	Describes me moderately well	6	7	8	Does not describe me well at all.
	1				5				9
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"/>
I could never 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"/>
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"/>
I am not 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"/>
Communicating scientific topics to others is not 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"/>
The logic/methods used in scientific fields are not 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"/>
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"/>
Scientific topics do not 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"/>

	Describes me extremely well	2	3	4	Describes me moderately well	6	7	8	Does not describe me well at all.
	1				5				9
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"/>
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"/>
I am not interested in helping others using 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"/>

Thanks so much for completing this questionnaire! To exit, please enter your passcode again here:

Appendix G. Workshop Post-Program Questionnaire

Lifelong Learning Group

April 2018

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Smithsonian- NMNH

Youth Programs

Intro

Congratulations for completing the NMNH Workshops!

The purpose of this questionnaire is to help us learn more how participating in the workshops has affected you and your science interests.

For a detailed description of how we will be using the information you provide, click on this [link](#). Please read it over to help you decide if you would like to participate. This questionnaire should take you about 15 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 NMNH youth programs in the future. 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.

Q?rius Youth Academy Classes

How much do you think the Entomology workshops will affect how you feel about studying science in school?

- No effect
 - At least some effect
-

You said the workshops will affect how you feel about studying science in school. Please complete the sentence in the text box below and then respond to the scale that follows.

I will feel more . . .

- A great deal
 - A lot
 - A moderate amount
 - Somewhat more than a bit
 - A bit
-

How much do you think these workshops will affect your interest in returning to NMNH as a visitor?

- No effect
 - At least some effect
-

You said the workshops will affect your interest in returning to NMNH as a visitor. Please complete the following sentence in the text box below and then respond to the scale that follows.

I will feel more . . .

- A great deal
- A lot
- A moderate amount
- Somewhat more than a bit
- A bit

How much do you think these workshops will affect your interest in visiting other Smithsonian museums?

- No effect
- At least some effect

You said the workshops will affect your interest in visiting other Smithsonian museums. Please complete the following sentence in the text box below and then respond to the scale that follows.

I will feel more . . .

-
- A great deal
 - A lot
 - A moderate amount
 - Somewhat more than a bit
 - A bit

How interested are you in applying for either of the NMNH Leadership Programs?

	Extremely	Very	Moderately	Slightly	Not at all
Q?Crew Volunteering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
YES! Internship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How much will your experience in these workshops affect you as a person generally interested in science?

- No effect
- At least some effect

You said the workshops will affect you as a person generally interested in science. Please complete the following sentence in the text box below and then respond to the scale that follows.

I will feel more . . .

-
- A great deal
 - A lot
 - A moderate amount
 - Somewhat more than a bit
 - A bit

How much will your experience in these workshops affect you as a person interested in pursuing a natural history major in college?

- No effect
- At least some effect

You said the workshops will affect your interest in pursuing a natural history major in college. Please complete the following sentence in the text box below and then respond to the scale that follows.

I will feel more . . .

- A great deal
- A lot
- A moderate amount
- Somewhat more than a bit
- A bit

How much will your experience in these workshops affect your interest in pursuing a natural history subject in a career as a **researcher**?

- No effect
- At least some effect

You said the workshops will affect your interest in pursuing a natural history subject in a career as a **researcher**. Please complete the following sentence in the text box below and then respond to the scale that follows.

I will feel more . . .

- A great deal
- A lot
- A moderate amount
- Somewhat more than a bit
- A bit

How much will your experience in these workshops affect your interest in pursuing a natural history subject in a career as an **educator**?

- No effect
- At least some effect

You said the workshops will affect your interest in pursuing a natural history subject in a career as an **educator**. Please complete the following sentence in the text box below and then respond to the scale that follows.

I will feel more . . .

- A great deal
- A lot
- A moderate amount
- Somewhat more than a bit
- A bit

How much will your experience in these workshops affect your interest in pursuing a career working in a **museum**?

- No effect

At least some effect

You said your experience in these workshops will affect your interest in pursuing a career in a museum. Please complete the following sentence in the text box below and then respond to the scale that follows.

I will feel more . . .

- A great deal
- A lot
- A moderate amount
- Somewhat more than a bit
- A bit

This last set of questions is about you and science. Please respond to each statement on the scale from 1 to 9 where "1" indicates the statement describes you extremely well and "9" that it describes you not at all.

	Describes me extremely well	2	3	4	Describes me moderately well	6	7	8	Does not describe me well at all.
	1				5				9
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"/>
I do not 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"/>

	Describes me extremely well	2	3	4	Describes me moderately well	6	7	8	Does not describe me well at all.
	1				5				9

To learn more about science, I often talk to others outside of school.	<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"/>
I could never 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"/>

	Describes me extremely well	2	3	4	Describes me moderately well	6	7	8	Does not describe me well at all.
	1				5				9

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"/>
I am not 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"/>
Communicating scientific topics to others is not 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"/>
The logic/methods used in scientific fields are not 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"/>
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"/>

	Describes me extremely well	2	3	4	Describes me moderately well	6	7	8	Does not describe me well at all.
	1				5				9

	Describes me extremely well				Describes me moderately well				Does not describe me well at all.
	1	2	3	4	5	6	7	8	9
Scientific topics do not 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"/>
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"/>
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"/>
I am not interested in helping others using 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"/>

Thanks so much for completing this questionnaire! To exit, please enter your passcode again here:

Appendix G. Q1. Academic Choices

YES!

Sub PRE	Sub POST
Science or Social Studies	Something having to do with science but I am not entirely sure what yet
The subject I hope to pursue is science.	I am interested in studying marine biology, marine conservation, and conservation science.
Biology	Biology, biochemistry, neuroscience
Biology, Biochemistry	Biochemistry, Biology
Microbiology, Nursing etc	Nursing Microbiology Neuroscience Cell genetics Premed
Academic subjects I'm thinking about pursuing in college is Screenwriting and Film & Television Production, World History and Art History.	Subjects I am interested in studying is TV/Film, Screenwriting, History, Meteorology or Forensic Science.
Computer science	Computer Science and International Relations
Biochemistry or nutritional science	biochemistry and french
Biology	Biology
Science, Math, English, History	Psychology , Medicine, Biology
I would like to pursue in medicine as my academic subject in collage.	I want to study chemistry or biology in college
Biology Medicine Human Anatomy	Medicine, Biology, Neurology
I believe I might Pursue science, math, and the combined field of engineering.	Engineering and psychology
biology	I plan on taking a microscopy class as well as a biology class.
Mechanic, Doctor, FBI or Forensics	Working as a Mechanical Engineer, working in the FBI/ Forensics, and a doctor (physician)
Mechanical engineering	Mechanical engineering Financial engineering Investing
Psychology, Sociology, Medicine, English, Education	Psychology, Neuroscience and sociology and possibly zoology.
Environmental science, geographic information systems, urban planning	geography, economics, public health, environmental science
I think i would want to Pursue in college is mathematics and science	Science Technology
I'd like to study in Antropology and or History, and Environmental Science.	Anthropology and Forensics Science.
Astrophysics or some type of engineering	I like space a lot so I was thinking physics with a minor in astronomy to become an astrophysicist. But now, I'm thinking more about possibly pursuing something in the biological field
Zoology Pre-Veterinarian studies	Zoology
Biology	Wildlife biology
biology premed	Pre-Med

Q?Crew

AcademicSubject.PRE	AcademicSubject.POST
	Biology
English, Foreign Languages, Musical Theatre, Evolution of Humans	Creative Writing, Drama, or Paleoanthropology
Computer Science, Chemistry, Medicine, Earth/Space Science, Mechanical Engineering (very undecided)	Medicine Materials Science Mechanical Engineering Environmental Science/Geology
	Biology, Epidemiology, Pre-med, Marine Biology, Zoology, Literature, Spanish, Math
Engineering, Cybersecurity	Engineering, possibly Environmental Engineering, and Public Policy
Sports, maybe chemistry or biology	I do not know yet, most likely in a field of culinary arts or sciences
	I am interested in studying art history, political science, and medicine/ biomedical sciences. But, because I am planning to attend medical school after college, I will most likely major in art history and political science so I can pursue those passions before going to medical school which will allow me to pursue all of my interests rather than fully committing to studying science in college.
anthropology Archeology	Anthropology and archaeology
History and biological sciences	Biology, Archeology, Ecology and Evolution
History	History, Anthropology, Human Rights
Math	Science and math
Science (especially natural sciences and biological sciences) and other fields relating to science.	Biology (of all kinds), ecology, natural history and paleontology, science education, museum studies.
History, science	Biology, Political Science, Engineering, Global Studies
Chemistry, Biology, Math	Neuroscience, biology, chemistry
STEM	Chemistry or engineering

Q?Crew Captains

Academic Subject PRE	Academic Subject POST
English, IR, History, Psychology	History business astronomy botany engineering
Ornithology. Mechanical engineering. Applied physics. Astrophysics.	Physics and applied science
biology	Biology
Biology, Physiology, Physics, Calculus,	Human Physiology and Biology
Literature/English, Archaeology, Paleobiology	Primarily English/Literature. Science would be a secondary interest, and could possibly lead to a career in science journalism.

Appendix H. Career Aspirations

YES!

PRE Career	POST Career
I would choose marine biology.	I would choose a marine conservationist.
a surgeon	doctor
Clinical Research Specialist or a Doctor of some sort	Medical Doctor
Doctor Physician Surgeon	A medical doctor
I would be a cardiothoracic or plastic surgeon.	Clean Energy Scientist/Engineer
	Trauma Surgeon
Something within IT	I am not sure. Maybe someone who works for the world bank.
An engineer, i am still uncertain of the specific engineer.	Engineer
Mechanic	Mechanical Engineer
Mechanical engineer	Mechanical engineer
I would be a Psychologist.	Therapist or psychologist
Pediatric doctor	Pediatrician
Science dealing with animals	I don't know really yet but it would be science related.
Veterinarian	Vet, or psychologist
If I had a choice right now, I would except my career as a Screenwriter or Film producer.	If I had to choose now, I would say I would expect my career to be in television production.
An anthropologist, that would be my major, at an institution.	Forensic Anthropologist
Research in the field of astrophysics	Astrophysicist
Veterinarian	Veternarian
Mammalogy	Wildlife researcher
A dietician	dietician
Mammalogy	Wildlife researcher
Gis analyst	public health professional
I would choose my career would be a surgeon.	I expect my career to have some sort of science to it like experimental stuff or it machinery
	Undecided

Q?Crew

ChooseCareer.PRE	ChooseCareer.POST
	Marine biologist
Musical Theatre Actress or Writer	Author
Epidemiology or Mechanical Engineering	Physician
	Epidemiologist

Cybersecurity	Somewhere in the Technology, Energy and Sustainability sectors
A chemist, or a chiropractor	Biology
	I expect I will become a doctor.
archaeologist	Archaeology
To work of research projects of either history or biology	Working at a natural history museum as a paleo biologist
Maybe an archaeologist or a political scientist	Anthropologist
Chemical engineer	Engineer
I don't think that I can choose right now, but I would probably say something related to science.	Biology.
A human rights lawyer	Marine Biology, Lawyer
Chemical Engineer	Medicine

Q?Crew Captains

Career.Pre	Career.Post
Law	Lawyer
Engineer or researcher	Physicist
A Dentist	Dentist
cardiothoracic surgeon	Cardiothoracic Surgeon
Novelist	Novelist

Appendix I. Content Learning

YES!

Science Content Learned
YES! has helped with my scientific knowledge of invertebrate zoology, more specifically echinoderms and what they are/where they came from.
YES! has enhanced my science content knowledge because it taught me a lot about microscopes that are used in a lab space as well as how an entomologist does their work. YES! also taught me that science communication is key.
My YES! experience has enhanced my science content knowledge in every way imaginable. I've learned how to properly recycle, how to prepare both insect and plants specimens, the agents of deterioration, about bio cubes and Australian beetles among many other things. The area of science content the YES! experience has helped me learn most is anthropology and more specifically cultural anthropology. With my project this past summer, I was able to see which factors influence humans and how they communicate, the origins of cell phones and how different communities are affected by cell phone infrastructure. I also was able to take a dip in forensic anthropology and examine bone casts of dead people.
My YES! experience managed to enhance my knowledge in trying to break down on how to analyze human bones and explain the age, the sex, the ethnicity and also understand the environment that the person was around before they died, or where the location was when they passed away or was murdered. This is a useful tool for me personally because it's involved with investigating and piecing together puzzle pieces in trying to figure out a murder and understand the purpose that comes along with the investigation.
I think that the area of science content that my YES! experience helped me learn the most was the idea that science and scientific discovery is not a straight line. Before YES!, I believed in the rigid scientific method where in order to have a valid experiment or conclusion the process of getting there had to be the same every time. After completing this internship I am much more knowledgeable about the "mess" that science is.
My YES! experience has helped me learn the most about animal conservation, environmental problems, and animal care. In regards to animal conservation, I learned that zoos are integral to the education of the public in this subject and that many animal populations have been helped through human intervention. In regards to animal care, I learned how to take care of a diverse array of animals and how to manage my time well. Specifically, I learned how to feed animals, check the temperature of their tanks, and set up exhibits. In regards to environmental problems, I learned that the plight of the environment and its unhealthy interactions with humans will turn into a plight on humans, and that humans have a responsibility to take care of the environment and work to reverse our effects on it.
There's a lot more science that goes on outside the headlines and really passionate people behind it.
Microscopy and insects
I have learned so much through my YES! Experience specifically the different areas of science and have learned more about how science is around us in our every day lives. Specifically the science behind helping animals and protecting them from danger both by nature and humans.
The YES! experience enhanced my content knowledge in both entomology and microscopy. I learned how we can use images and microscopy's tools to better understand the natural world and interactions between animals and their environments.
The YES! internship helped me discover many branches of science that I did not know existed in the real world of science. I think my biggest learning outcome was the process it takes to preserve organisms and species from hundreds of years ago. The chemical composition of those preservatives and the storing techniques it takes to maintain them looking in a good condition for further research and exhibition.
The area that the YES program helped me learn the most is working with others around you to finish your goal.
The YES program helped me by expanding my knowledge on topics I never would've picked to learn about by my self. It helped me to learn many things over my summer internship there.
The YES! experience allowed me the opportunity to engage in hands-on scientific methods such as DNA extracting, analyzing and sequencing which enhanced my science content knowledge. Learning these techniques encourage me to continue to follow my dream of acquiring a science related career.
My YES! experience has enhanced my science content knowledge because I got a chance to learn more about my environment and the history of our environment while working with ginkgo trees and CO2. I learned how to effectively communicate my work in science to a small and a large audience. I learned and got a better perspective of topics in Botany, Zoology, Anthropology, Paleo and more.

<p>During YES 1.0 I was a rising junior and the year before I was in 10th grade and studying Chemistry. I enjoyed chemistry class but I didn't learn much more than what was taught in the classroom. During my internship me and my partner, Daniela Tortoza went to visit MSC, The Museum Support Center, with our mentor Irene. There we performed a series of experiments on liquid preservatives like Formalin, Isopropyl, and ethanol. This experience helped me better understand these fluids and complex experiments like titrations and the pH of alcohol. I also learned that formalin comes from formaldehyde, where at first I thought they were two different fluids.</p>
<p>The yes program has shown me the reality of science from what is taught in classrooms. I saw science as something boring and step by step, but from working in the Entomology Department and from YES I've learned it's not. Science is something that's boring but fun and full of trying and discovering new things. I also learned that science isn't step by step like but it's like a cycle where you can enter at any place.</p>
<p>Honestly, with the variety of things we did, my knowledge about science has increased more than I can even write about. I learned the most in depth with my mentor. I learned so much about microbiology and DNA. She taught me about the process, needing to isolate DNA, how the genetic codes work.</p>
<p>I experienced a lot in the area I am interested in which is hard for those my age. I was able to do hands on and was always able to ask questions. I learned how to communicate the knowledge that I learned in new and innovative ways.</p>
<p>I learned many things about many different topics. My knowledge of biodiversity increased. I learned about the importance of it and how it could be used to help scientists. I also learned a lot more about climate change and how it's an urgent matter and not a conspiracy theory. I also learned a lot about how fossils and bones can be used to identify important information about an organism. Not to mention the skills and knowledge I gained by working at the zoo. Overall my knowledge has expanded.</p>
<p>I learned many things about subjects I never even thought about in school. YES! gave me the experience in working with a scientist and doing actual field work, which helps me narrow down what I want to do in college. Without it, I do not think I would have been a science major.</p>
<p>The YES! Experience has enhanced my scientific knowledge specifically in the areas of paleobiology and environmental science. I have become more aware and more interested in the possession of knowledge known from research about past ecosystems. For instance, I learned about the preservation and existence of mammoths which was really interesting. Additionally, I've learned anthropological aspects that existed in these past worlds through artifacts such as weapons and human remains. I've come to find about the importance of record keeping and the importance of the smallest details in science.</p>
<p>It has helped me learn more about caterpillars and also how to use a scanning electron microscope</p>

Q?Crew

<p>SciContentKnowledge</p>
<p>I learned more about specific things, especially in the collection zone, I learned more about the specimens I wanted to learn about. I also tried to learn about things that generally doesn't interest me, such as rocks and minerals.</p>
<p>Not only have the enrichment classes and my interactions with visitors day-to-day given me more information that I can use when talking with visitors, being able to interact with a wide range of ages and backgrounds has helped me to hone my skills in being to communicate scientific knowledge.</p>
<p>I discovered the field of physical anthropology over the summer, and I learned much about the kinds of research occurring with the museum specimens. Through the exposure that Q?Crew provides, I was able to get in contact with Kari Bruwelheide and gain insight on how the museum's bone collections can help answer historical questions and contribute to our understanding of the past. Also, it's very mind blowing. My mind has been blown.</p>
<p>My Q?crew experience has enhanced my science content knowledge mainly from the hands-on activities that they have in the center. I have learned a multitude of various facts from these stations.</p>
<p>Numerous fields from the progression of human evolution and understanding the web of species, to early human anthropology and the creation of tools, insect classification, the difference between butterflies and moths, however the area I learned the most I was geology and I was able to gain a very deep understanding of rock & mineral formation and the rock cycle that school could not provide me with.</p>
<p>Well, through Q crew I've been able to learn a lot more about the environment and of the natural world. For example, I would always show visitors my favorite object in the collection zone. It was a rock that cows would digest to help grass go through their digestive tract and then was pooped out.</p>
<p>Through volunteering at Q?rius, I have learned more about cultural anthropology. The artifact of the block of tea has introduced me to how functional objects, goods, and materials can also have an aesthetic value.</p>

My Q?crew experience has greatly enhanced my science content knowledge. Before being a member of Q?crew, I did not know a great deal about rocks and minerals, but being in the collection zone, facilitating activities, and participating in programs greatly increased my knowledge of this content.
Through the enrichment, I have learned more about human anatomy, misconceptions about science and what is behind the scenes of a science museum. These opportunities were only available through Q?Crew which helped me apply my newfound knowledge in school and the outside world.
I have learned about several different branches of science from the artifacts in the collection zone. The one that I learned about the most is anthropology from the human skulls in the collection zone and anthropology sessions during the summer. I learned how scientists use bones to discover the cause of death of an individual. Also, through the social scientist shifts I have learned how data is collected and how observations are completed in the social science field.
Q?Crew has enhanced my science content knowledge greatly in how much I know, how well I know it, and a bit on how I view it. I now know much more about just about every field of biology, more about natural history, and more about how science, especially biology and natural history is approached and worked on by professional scientists. Because of this, I feel more prepared to go into a field of science in the future myself. Perhaps the area of science content my Q?Crew experience has helped me learn most is how to communicate and approach science.
My Q?Crew experience has helped to improve my knowledge of anthropology, especially through the use of the objects in the Collection Zone. I have also improved my knowledge of human evolution through the skull activity in the Field.
I have stronger variety of science knowledge because of the various objects in the collections zone

Q?Crew Captain

Content Learning
Learned about paleontology and botany Learned a lot about specific collections objects and random creatures
The learning that I did with bird lab and the forensic ornithology team gave me the most content. Learning about the processes that they use to ID birds, the various levels of microscopy, microstructures, and pigmentation and the use of this element in the feather was really insightful. This was also a window into how research in ornithology is done and the steps in the ID process is done.
Not only was I able to learn how to communicate, but I was also able to build a relationship with the Smithsonian. By demonstrating my professionalism and my passion for science, I was able to show my interest in working further than volunteering. This summer, I was able to gain an internship role at Q?rius, where I will mentor the new volunteers and create an activity for the museum. From my volunteering experience, I was able to mentor how to help visitors interact with the Q?rius Space. I've made the new volunteers feel comfortable interacting with the visitors by demonstrating how to interact with visitors. With helping the volunteer, I had to demonstrate a leadership role, because my colleague and I were in charge of training the new volunteering and demonstrating best practice. For my project, I was able to work with different Smithsonian's staff to help develop my project for the public. In this environment, I had to be professional when meeting the staffs because it was a serious matter. At the same time, I was able to get to know the different professions that contribute to the museum. This internship was very important to me because it gave me new perspectives and gain experiences in the professional field.
Working at Q?rius helped me learn how to collaborate with others and learn more about the world around me.
For me, being in Q?Crew has enhanced my scientific knowledge in a variety of fields. Specifically, as a Captain, I have much more time on the floor to find new and interesting objects, and more opportunity to interact with visitors who may have some science knowledge that I do not. For example, one visitor explained a species of coral that grows around mating shrimp to trap them inside and digest them, but allow the shrimp fry to escape. However, I would say that I generally have much more knowledge about the scientific 'method', and its non-linear nature, than I had before entering Q?Crew.

Lifelong Learning Group

a-46

Smithsonian- NMNH

April 2018

Youth Programs

Appendix J. Discussion group questions and responses

1. Change in Science Identity.

Some students became less science identified. Talk about what you think explains this finding. How do you think those findings relate to the improved science identity findings in the per item detail.

- found it easier to communicate science because of the reach 100, but in the actual internship, the mentor relationship was strained.

-1.0 started with learning the proper foundation. As 2.0, you learn even more, you're even more engaged. In 1.0 kids come in saying "I already know this." But they have to learn. Maybe they don't like being treated like children, but it's necessary to get that foundation. The 2.0s felt more connected.

Reasons for some interns losing interest (the group consensus was that they could name 5 of the 25 who did).

They already know enough.

Some didn't arrive with as much interest

Learning wasn't a priority "I don't really need to know this."

Their expectations were too high, e.g. they expected they would be working in a lab with a actual scientist. But 1.0 involves a lot of learning. It's more about exploring.

Not very adult

What would help?

To expect more of them. Reminder that it's still a job. Field trips kind of confuse that.

Some people didn't treat it as a job. E.g. hanging out on their cell phone, returning late, taking long bathroom breaks. They treated it more like summer camp than a job.

Be more careful about the people they choose

Make it look stricter than it is. That way you get people really interested and committed.

Make sure people have a direct interest in science.

Connect it more with college.

Past YES! interns came and spoke to us – it was optional; 10 people showed up.

What's important is their interest in STEM and being committed to a professional work ethic.

I valued the internship so much. My mentor kind of changed my project to be what I'm interested in (tech programming). Toward my interest in tech programming. That's why a good mentor is so important

2. Basic Psychological Need Satisfaction Trends

Note that sense of autonomy is inching it's way upward, but sense of competence and relatedness this past year looked more like two years ago. Also note that need frustration hovers around "somewhat disagree." Talk about what you think might explain that finding.

Lack of interest.

They didn't understand the purpose; [saw what they were asked to do as] meaningless tasks; they didn't pay enough attention to understand.

If my partner wasn't interested, I'm annoyed.

Rushed explanations, e.g. pinning moths. I don't like bugs, but gradually I go to like them. We had a class on pinning beetles. We were pinning moths and I was touching it wrong. I had no idea what I was doing. Someone else was saying "nice job." But not to me. The guy was doing it, but not helpful. He was helping people who knew more.

A lot of the scientists are anti-social; cold and not teaching. Assuming understanding. Find people who know how to talk to teens. Assumed we all knew. Sometimes I had to pretend I knew. Then I did outside research on my own—that was sort of annoying. But I figured it out.

Egos and "better than" opinions.

As a whole group we weren't all united and embracing.

Last years the 1.0s, 2.0s and 3.0 s were separate. Theist hear the issue was with the people who were less interested. There may also have been an issue between seniors and freshmen

Belief systems clashed sometimes. For example there was an issue between two people—one who could see multiple perspectives, multiple ways of seeing the world—spiritually as well as scientifically. The other would only accept a science perspective.

[So when they're reviewing application they should consider, "will this person get along with others? Will they appreciate the learning? Who needs what? Then choose the person who says "I know a little; I want to know more" and not the person who says "I know this already."

3. Relationship to mentors and museum staff.

What did mentors do to help you feel competent, related, autonomous?

Mentorship that works

I was in conservation. My mentors brought me into their world, like at lunch with their colleagues, they treated me like a colleague too. They introduced me to the people [in their professional circle].

I loved my mentors. That's what will be written on my tombstone. They took me to restaurants. I think they were told, "Go take your kids to dinner." Some did; some didn't. [The Microscopy Educator] took us out. That was more important than going with scientist. They make me feel like my work was important.

I felt like I was changing science. They showed me how my research will be used in real life applications. They could explain so easily (unlike the bug guy).

They would say how good a job we were doing. When they corrected us, it was respectful. Treated us like a colleague, calling each other by first name.

I was part of their summer, rather than vice versa. They would stop their workday and include me and my partner.

My mentor (unintended but not organized well. Getting caterpillar food.

Scientists were mostly absent, [the Microscopy Educator] was [the Youth Internship Coordinator] for the 2.0s; [the Microscopy Educator] was amazing.

4. Boot Camp

Boot Camp. *Talk about how the preparation week affected your basic psychological need satisfaction (your sense of competence, relatedness, and autonomy) when you came to the program. What worked? What particularly helped? What didn't work? What was daunting? What suggestions do you have to improve the prep week for next year?*

One day – about visitors, but we didn't. I think I fell asleep. I never used that information. It was irrelevant. I day scavenger hunt was really fun. I messed it this year (2.0 didn't do it; 1.0 did): got to meet people; explore the museum; and it was fun.

It made the big look small; no longer intimidating. First day I came dressed up; some others were dressed up and some were people in jeans. How people dress shows your personalities.

They told us to dress "business casual." But *what is business casual???*

2.0s had to repeat lessons a lot of repeat. Maybe side field trips or same ones but with different activities would work better.

Canoeing was SO much fun – relationship building

We were in Annapolis the day the shooting happened. And then we broke off into groups, it felt isolating [at a time when we really needed to be together]

[Youth Volunteer Coordinator] did great improve exercises

Team building [shouldn't end with boot camp week] It should be repeated throughout Like I don't even remember everyone's names.

Keep [the Microscopy Educator] as 2.0 mentor. And keep 2.0s together. [we learned a lot from each other]

We loved Katie, Josh, Hannah, [the Microscopy Educator] and [the Youth Internship Coordinator].

If you had a bad day with your mentor- there were others to balance it out.

Appendix H. Q3 Interview Scripts and Questions

Community Collaborator Interview scheduling email:

Hello ---

We are writing from the COSI Lifelong Learning Group in Columbus, Ohio. Perhaps you recall that Nicole Webster from the National Museum of Natural History asked if you'd be willing to have us contact you. We are working with NMNH to support the quality of their youth programs. Part of our effort this year is to learn more about how the youth programs can partner with community organizations to bring NMNH resources to young people in the Washington DC community. Nicole has provided your name as a key person to talk about the relationship you have already established with them and your ideas for strengthening that relationship.

We would like to schedule a time for us to talk via video chat for about a half hour. Our interview will consist of nine questions (which we've attached so you can think about your responses in advance). Might you have available any of the times listed below? As soon as I hear back from you we can schedule a time. We look forward to talking with you.

Sincerely,

Deborah Wasserman and Rebecca Nall

Intro Script and Questions.

Hello, my name is Rebecca from the COSI Lifelong Learning Group in Columbus, O. As you probably know from Nicole (or as we already explained when we set up this meeting), our research team is working with the National Museum of Natural History to support their youth programs and more specifically, how they can best serve local youth—especially those who typically have limited access to science careers.

So before we begin, I want to ask you if it's ok with you if I record this conversation. This interview is for program purposes only, we will not be sharing any of your information outside of the project team I will be taking notes, but as a backup would like to record our conversation. Is that ok with you?

Ok, then I'll start the recording now. Just for the record, do I have your permission to record this conversation? If there's anything you would like me not to record, please ask me to stop the recording. If there is anything you would like me to not share with the team please let me know and I will respect your request. You are free to stop the interview at any time. If this all sounds good, we can begin.

9. Describe what you know of the NMNH youth programs and how they function (or fail to function) as a resource to the youth in your program. [prompt for YES!, Q?Crew, Workshops, and Teen Night Out; In what ways do you understand NMNH youth programs to be a resource to the youth in your program]?
10. In your program, about how many students each year would you say would be interested in/could benefit from NMNH youth programs? Does the number of those who would benefit differ from the number of those who are interested? If so, what makes the difference? Kind of person or list?
11. What conditions make it difficult/over-challenging/uninteresting for youth to consider participating in NMNH programs? applying for them?
12. What strategies could the program use to best appeal to or reach out to the youth in your program? Prompts: send speakers? Help with applications?
13. What could NMNH do to help you know the program well enough to talk about and promote it? [Prompt: send more information; send regular updates about accomplishments; invite you to observe, send a representative to explain the program to your youth participants.]
14. What other similar opportunities are available to the youth in your program? How do you choose which to promote and for what reasons?
15. In what ways would you use the term "community partner" to describe your organization's relationship with the NMNH youth programs?
16. NMNH is looking to reach the youth in your programs who can benefit from NMNH internships, research opportunities, and volunteering. More than just seeking referrals, NMNH is wanting to be an active partner with you in providing quality opportunities for these young people. Youth program staff are wanting to understand ways they can function as an authentic collaborative partner with you. Can you think of ways they might work with

you or your organization to best function as a resource? Can you think of other collaborative roles they could or should assume?

17. What else would you like to add? Is there anything else you'd like the museum staff or museum educators to know?