

Long-Term Impact of Teen Science Cafés

Results of a Pilot Study with Café Scientifique New Mexico

November 14, 2018

Prepared by:

Jessica Sickler, M.S.Ed.

Prepared for:

Science Education Solutions



J. Sickler Consulting, LLC

Research, Evaluation, & Consulting Services

www.jsickler.net

412.552.3027

jessica@jsickler.net

Executive Summary: Pilot Study of Long-Term Impact of Teen Science Cafés

A Teen Science Café is an out-of-school program that brings together teens and science professionals to engage in discussion and activities related to the scientist's work. The Cafés are highly interactive, incorporating hands-on activities and discussion with scientists; each is co-organized by an adult and a group of Teen Leaders. The model was developed and refined in several different locations in New Mexico between 2008 and 2010.

This pilot study took advantage of the 10-year history of Café Sci NM, and sought to answer the question: What are the long-term influences of participation on alumni's academic, professional, and personal trajectories? The study used a retrospective approach to tap into the memories and life experiences of alumni. Phase 1 was a survey of alumni known to have participated regularly between 2008 and 2010 (n=57); Phase 2 included follow-up interviews and focus group discussions with 11 alumni who represented a range of experiences.

Café Sci was a very good experience.

Around 70% of alumni surveyed recalled Café Sci as being "very good." While only one person recalled it as "one of the most important" experiences they had had, the vast majority described it as having been fun, social, and an opportunity to learn about interesting topics and to meet working scientists.

The qualitative and quantitative data both indicated that Café Sci's power came from its combination of features that created a teen-centered, casual, intimate learning environment. Survey data did not point at one singular element that alumni had liked best, but a set of attributes. In interviews, alumni articulated how these characteristics combined to create a novel environment. The cafés were casual (time and space for socializing, food, other incentives); they were comprised of a small group of peers who were there by choice – either interested or curious about science; and they allowed for interaction with the scientists, who talked about real research and its application. This experience contrasted sharply with school science and with other available STEM after-school experiences – which were either competition formats or intensive research experiences in a lab.

While most alumni remembered Café Sci positively, the data suggested that former Teen Leaders had stronger and slightly more positive recollections. Interestingly, this was the only impact area in which former Teen Leaders had a substantially different reaction than general alumni. Qualitative data suggested that the impacts of being a Teen Leader were less directly STEM-related, and were more in the development of "soft skills" of organization, leadership, planning, and confidence in one's own abilities.

Alumni pursued STEM study and jobs.

The vast majority of Café Sci alumni majored in STEM subjects at the undergraduate or graduate level; and around half of those who hold jobs are in STEM fields. This number will likely increase in the next several years as students pursuing advanced degrees (MD or PhD) complete their schooling. These rates far outstrip national patterns.

However, many alumni do not attribute their Café Sci experience to substantially shaping this outcome. About 20% of survey respondents described Café Sci as having helped influence, reinforce, or clarify their aspirations for STEM study or careers. Around 26% rated it as "somewhat influential" in their career choices. Based on interview data, many students came to Café Sci with well-established goals for STEM careers. For these students, the program provided different benefits, such as giving first exposure to what it really looked like to do science as a professional.

Another influence on career paths were a handful of alumni who revealed that the experience had influenced other aspects of their professional lives. This ranged from a former Teen Leader who may have uncovered here interest and skill at project management and strategy to another who found a way to reconcile that it was OK to love science but not make it your life's work. For a couple of alumni who are STEM professionals, they noted how they are thinking back on Café Sci as they now begin to engage in STEM outreach activities, this time as the scientist-presenters. These examples point to the diversity of personalized ways that the Cafés have professional impacts.

It made science tangible and personal.

Among the ways that Café Sci might have influenced an alumnus/a, two that had most resonance for alumni related to improving their understanding of what science was and how it worked in the real world. 40% or more of alumni rated Café Sci as having been “very” or “extremely” influential on their understanding what scientists do and awareness of science careers.

These themes were echoed in the qualitative data, in which alumni describing the experience as having made science more “tangible,” and contrasting it as extremely different than the way they learned school science. This was consistent regardless of whether individuals were already on a STEM-career pathway before they came to Café Sci or not. The interactions with real, working scientists, who demonstrated their passion about their work and the relevance of how this work would impact the world was starkly different than learning concepts and conducting routine experiments in high school.

The other area of impact that emerged seemed to be in the ways Café Sci helped support and nurture individuals’ emerging science identity. The critical factor here seemed to be that Café Sci brought together a small group of like-minded, interested teens. 38% of alumni reported that Café Sci was “very” or “extremely” influential in helping them “feel there were others who shared my interest in science.” In interviews, alumni described why this was so important for them. Some, again, drew the contrast with school science classes; at Café Sci, everyone was there by choice and it made for a more welcoming, accepting learning environment. Some described how Café Sci, and this group of peers, was critical for developing a sense that it was OK to be into science – something that can be difficult for adolescents; another example highlighted how having that casual, safe entry-point to science may have been critical in his journey.

And for a few, there have been individual Café sessions and topics that have stuck in their memory all these years later. Interview data revealed that this had the potential to cultivate a lifelong interest or attention to a topic – such as one alumnus who has continued learning about a particular field (that is not his career) because of an interest sparked at Café Sci.

Impacting less STEM-involved teens.

While there were very few differences between subgroups of alumni on most of the measures, we found the greatest differences to be based on whether or not the alumni had been involved in other STEM activities in high school, beyond Café Sci. The differences were only on a few variables, but they showed that Café Sci seemed to have stronger influence on those who were not involved in other STEM activities.

For instance, alumni for whom Café Sci was their only STEM-related activity reported that the program was much more influential on their knowledge of science. They also were more likely to report that Café Sci prompted them to be more interested in STEM-related life-long learning activities, including reading science articles, talking about science with friends and family, and watching science-related television programming.

This supports some of the qualitative data, where alumni who had other STEM-related experiences noted that they felt like there were limits on how much Café Sci had impacted them because of these other experiences. They described being already immersed in a lot of real-world science learning – whether from parents who worked in STEM or doing work in research labs while still in high school. In contrast, alumni for whom Café Sci was their only experience more clearly pointed to the benefits of Café Sci at exposing them to ideas and information they would never have seen otherwise. As one interviewee, who had not pursued STEM study, noted – Café Sci was the greatest amount of science he’d been exposed to, outside of high school classes. While this type of program has value for many participants, it seems that its welcoming, casual, social environment has the potential to be particularly influential at shaping science knowledge and interest for the students who might not otherwise get involved in traditional out-of-school STEM activities and/or who may not be on a STEM career pathway.

Table of Contents

Introduction	1
Study Purpose	1
Methods.....	2
Phase 1 Survey.....	2
Phase 2 Interviews	3
Survey Sample: Demographics.....	4
Survey Sample: Café Participation.....	6
Results	7
Memory of Cafés.....	7
Perception of Experience.....	7
What They Liked Best.....	8
Memorable Café Sessions	10
School & Career Paths	11
Schooling & STEM Studies.....	11
Careers & STEM Pathways	13
How Café Sci Influenced Alumni.....	15
Strongest Areas of Influence	16
Café Sci vs. Other Youth Experiences.....	17
Influence: It Made Science Real.....	18
Influence: Perspectives on Science	18
Influence: On Career Path.....	19
Influence: Science Outreach Activities.....	20
Influence: Other Skills & Mindsets.....	20
Life-long Learning Activities	21
Comparisons by Subgroups.....	23
Teen Leaders.....	23
Demographic Variables.....	26
Discussion & Conclusions.....	27
References	29

Introduction

A Teen Science Café is an out-of-school program that brings together teens and science professionals to engage in discussion and activities related to the scientist's work. Different than adult-oriented Science Cafés, a Teen Science Café is a highly interactive program that incorporates hands-on activities and discussion with a science professional to engage teens with the content and personal stories of scientists. In addition, a group of Teen Leaders work with their adult organizer to guide their Café – from program design to speaker selection and vetting.

The program model for Teen Science Cafés was initially developed and refined in the U.S. beginning in 2008 at several different locations in New Mexico – Los Alamos, Albuquerque, Espanola, and Santa Fe. Evaluation of Café Scientifique NM produced robust evidence of the short-term impacts the Café had on teens' attitudes toward science, scientists, and careers, as well as fostering a sense of belonging and connection with the Café (Hall, et al., 2013).

From this success, the national Teen Science Café Network was founded in 2012. The network established a community of practice providing high quality resources and support to organizations implementing their own Cafés. As of fall 2018, the TSCN included more than 100 established and emerging sites in 40 states and Canada.

Study Purpose

This pilot study took advantage of the long history of Café Scientifique NM, where Cafés have been regularly occurring for 10 years. The study sought to answer the question: **What are the long-term influences of Teen Science Café participation on alumni's academic, professional, and personal trajectories?**

The study was intended to be a retrospective look at the ways in which participation in Cafés are perceived to have influenced the academic, professional, and personal trajectories of alumni in the 8-10 years after participation. This type of retrospective study is used to tap into the memories and life experiences of alumni in an effort to construct how they feel program experiences contribute to their choices and interests as adults. Recent studies have used this approach effectively to understand the influences of youth programs in STEM and in the arts (Linzer & Munley, 2015; McCreedy & Dierking, 2013).

Within the overarching research question, the study articulated several specific lines of inquiry, displayed in the Research Sub-Questions listed below.

Research Sub-Questions:

1. What is most memorable about Teen Science Café experiences for alumni?
2. What academic and career paths have been pursued by Café alumni? How many pursued STEM-related careers?
3. In what ways do alumni feel Café involvement influenced their studies, career choices, lifelong learning habits?
4. Are there any other ways that alumni describe the influence of TSC participation on their lives?
5. Are there differences in long-term influence between Teen Leaders and general attendees?

Methods

The study used a two-phase, sequential mixed-methods approach. In the first phase (quantitative), all qualifying alumni were surveyed to obtain a comprehensive picture of how they viewed impact on their life journeys. This was followed by a qualitative phase, in which a sub-group of alumni participated in virtual focus group interviews to explore their reflections in greater depth.

Phase 1 Survey

Study Population & Recruitment

The population for study was limited to individuals who participated at one of the Café Scientifique New Mexico (Café Sci) sites between 2008 and 2010, and was recorded as having attended at least three Café sessions. This minimum level of attendance was selected as qualifying a youth as having been a “participant,” eliminating teens who may have dropped in for just one or two sessions.

Staff at Café Sci assembled the list of names and updated contact information for as many alumni as possible, using personal contacts, Facebook, and LinkedIn to obtain updated information. From a list of 159 names of past participants, some contact information was found for 103 people (65%). Of these, **78 Café Sci alumni met the criteria for minimum level of attendance.** We will refer to them as “alumni” throughout this report.

Because we did not have contact information for all potential alumni, a variety of methods were used to invite participation. First, direct email was sent to each individual for whom we had an email address (n=71), and direct Facebook messages were sent to those for whom that was our only contact (n=7). Then, Café Sci posted a general invitation on their Facebook page. Finally, responding alumni were given a link that to share with friends who had participated in Café Sci. An incentive was offered (\$5 gift card) for completing the survey.

Ultimately, 57 alumni responded to the survey in part or in full; 46 were from direct email and 11 were from general links on social media. This was a 59% response rate to the email contacts, and overall approximately a 65% response rate. This is a strong percentage for this format, but responses are more likely to have come from those with stronger recall.

Survey Instrument & Analysis

A survey instrument was developed to explore the themes identified in the research sub-questions. The survey consisted of a mix of closed-ended and open-ended essay questions. The construction of survey questions and items was informed by prior retrospective research on youth programs in informal settings (Linzer & Munley, 2015; McCreedy & Dierking, 2013; Sickler & Johnson, 2009). The questionnaire was developed as a web-based survey that could be completed on a computer, tablet, or smartphone.

Data from open-ended questions were coded for analysis, with coding dependent upon the type of question asked. Open-ended reports of alumni’s major fields of study in undergraduate or graduate school were coded into categories derived from NSF’s classification system for fields of study (Publication 15-321), and occupations were classified using the Department of Labor’s Standard Occupational Classification manual. They were grouped into STEM and non-STEM, and then several sub-disciplines within each of these groups.

For responses to open-ended questions about the benefits, impact, and memories of Café Sci, thematic codes were developed based on more common responses across the sample. Each response was coded in one more of the themes (by question) that represented the ideas being expressed. This allowed for the quantification of how common each theme was in responses.

Across all data, descriptive statistics were computed; primarily frequency distributions were calculated, but in some cases mean or median ratings were analyzed and reported. To answer some of the research questions, statistical comparisons were run to compare responses from two groups (e.g., former teen leaders and general attendees) to look for differences in how they reported impacts from the program. Non-parametric statistics were generally used due to the smaller sizes of sub-groups.

Phase 2 Interviews

Study Population & Recruitment

Interviews were conducted with a nested sub-sample of alumni who completed the survey. At the end of the survey, respondents were asked if they would be willing to participate in a follow-up virtual focus group, with an offered incentive of a \$40 Amazon gift card for participation.

18 responding alumni (37% of those who completed the survey) indicated interest in the follow-up study and were contacted to schedule a convenient time for an interview. In the end 11 alumni participated in virtual focus group discussions or one-on-one interviews (for situations where group scheduling proved logistically difficult).

These respondents were a convenience sample, comprised of those who were willing to participate and responded to scheduling requests. However, they represented a variety of experiences with Café Sci – from casual attendees to Teen Leaders and those from both the Albuquerque and Los Alamos sites. The range of experiences and discussions of impact in those interviews mirrored the patterns seen in the overall data, which allows this sample to help interpret and understand the survey results, even if the respondents were not selected randomly.

Interview Protocol & Analysis

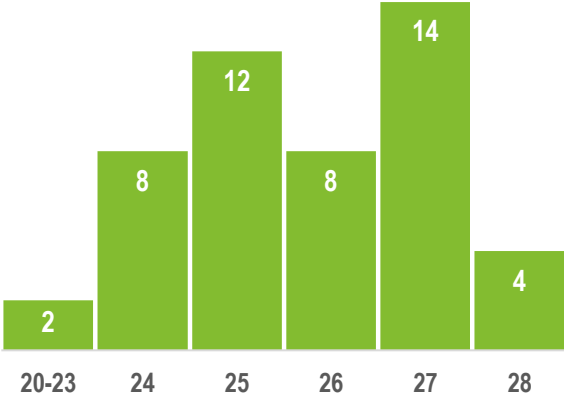
After preliminary review of the survey results, the interview guide was developed to structure the focus group discussions with alumni. The primary purpose of the interviews was to gain greater depth and insight into the perspectives of alumni, particularly stories of how Café Sci influenced or impacted choices or attitudes later in life.

For the most part, interviews were conducted as virtual focus groups using a videoconferencing platform. Participants logged in at a scheduled time and could use webcams to more closely mimic a face-to-face discussion; however, a call-in option was also provided so that technical limitations were not a barrier to participation in the study. Conversations were recorded (with the participants' consent) and transcribed for analysis.

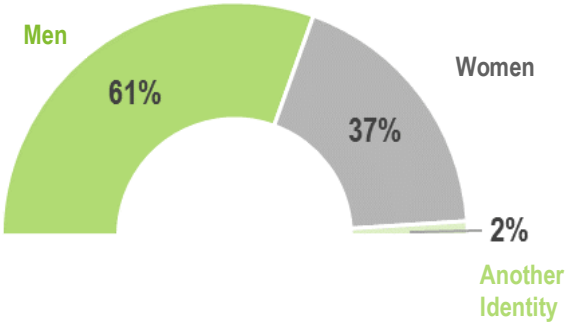
The transcripts were reviewed and a process of open-coding used to determine what themes emerged in relation to the guiding research questions. When a set of themes was established, transcripts were read, and specific excerpts were placed into the codes that represented ideas being expressed by participants. Due to the non-representative nature of this sample, coding was not quantified; rather, the coding sought to help illustrate more richly themes that were seen in the quantitative analysis and to uncover different perspectives that may not have been expressed in response to the survey's structured questions.

Survey Sample: Demographics

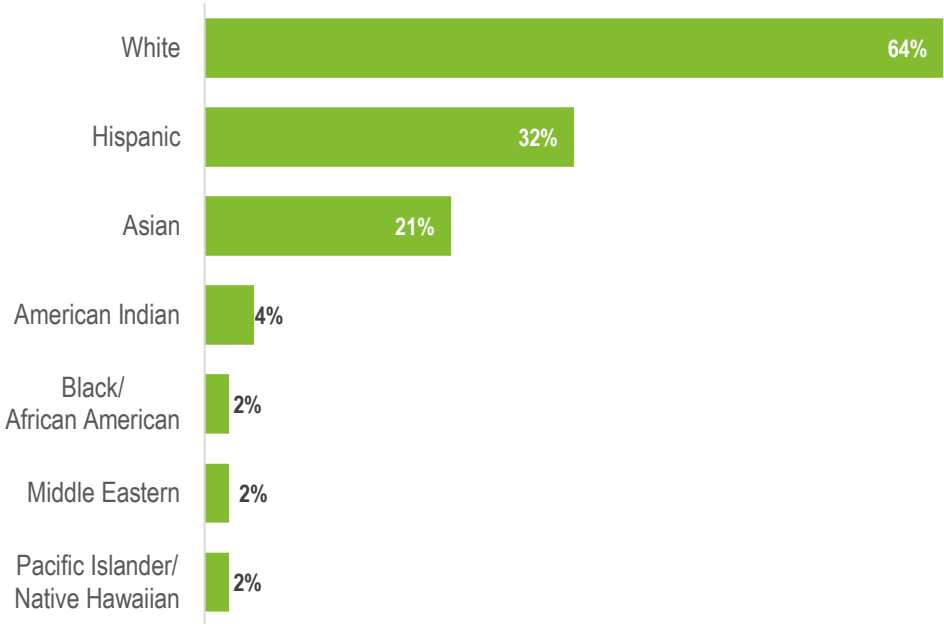
Respondents were an average of 26 years old. Most alumni were between 24 and 28.



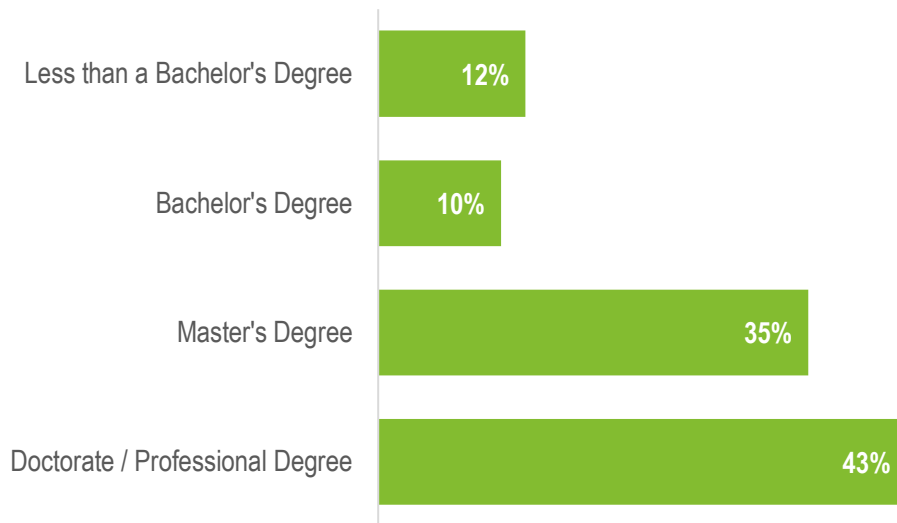
Men represented almost two-thirds of respondents; women comprised over one-third of the sample.



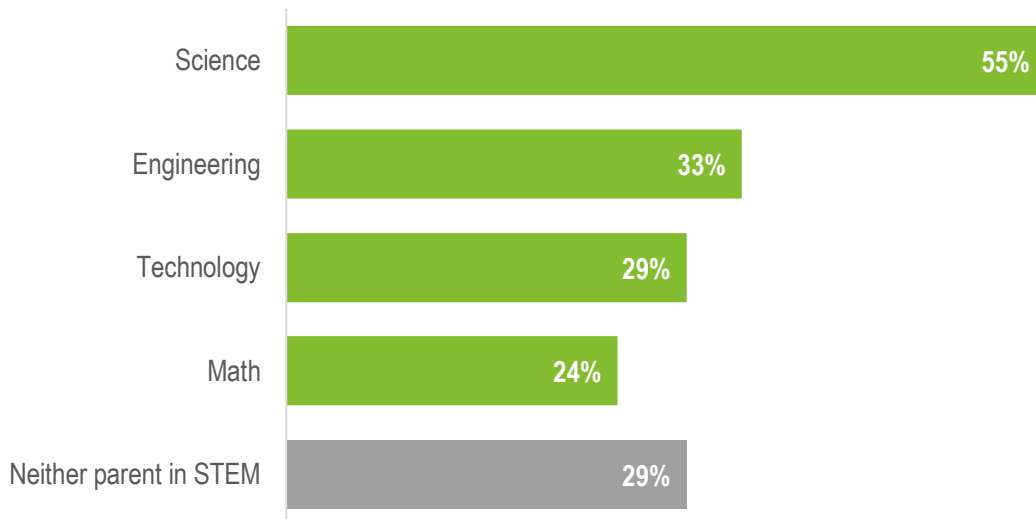
Most respondents identified as white. Hispanic and Asian race/ethnicities were the next most common among alumni.



**Responding alumni tended to come from highly educated families.
78% of respondents had a parent with a Masters or Doctoral-level degree.**



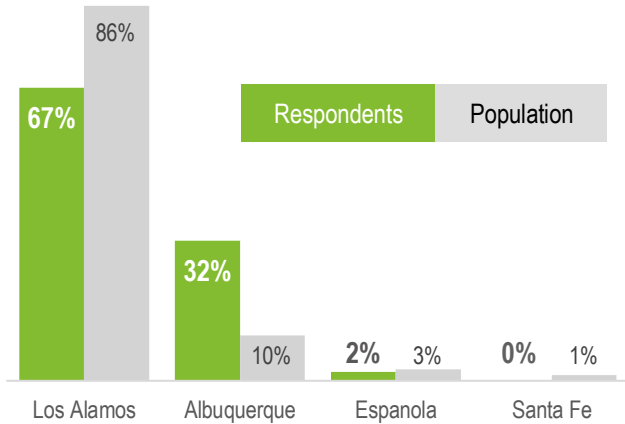
Around 70% of responding alumni grew up with parent(s) working in a STEM field.



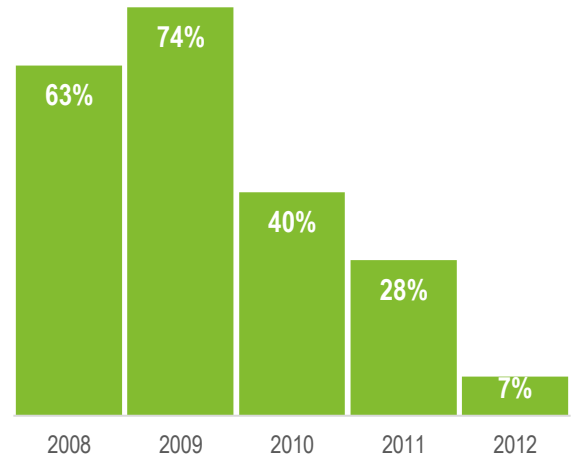
Survey Sample: Café Participation

Most **responding alumni** had participated in **Los Alamos or Albuquerque**.

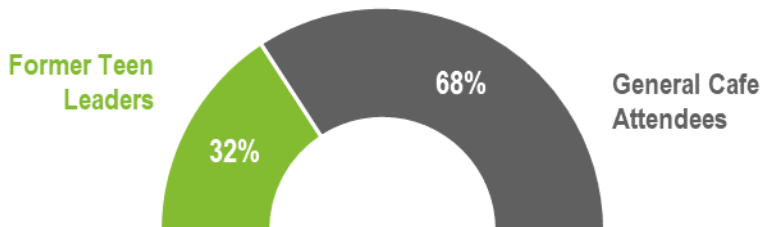
Response rate from Los Alamos alumni was slightly lower, and response rate from Albuquerque alumni was slightly higher.



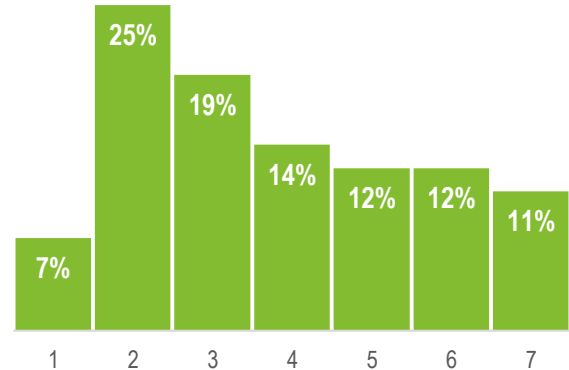
Most responding alumni had participated in the earliest years of **Café Scientifique New Mexico**.



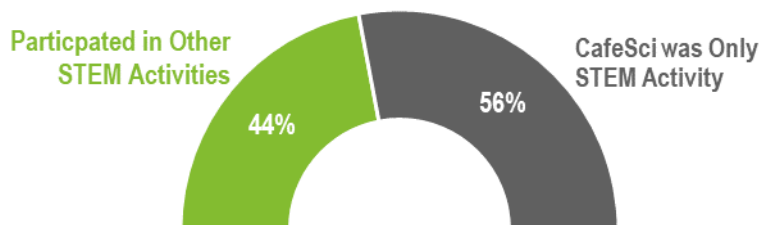
About one-third of the sample had served as **Teen Leaders** for the Café in high school.



On average, Alumni **recalled** attending around **3 or 4 Cafes per year**.*



The sample had an even mix of alumni who had **participated in other STEM activities** in high school and those who had not.



**These data represent alumni's self-reported recollections of how frequently they attended Cafés, in general. Due to inaccuracy of memory, official program records remained the main criteria to determine whether individuals were eligible for the study as semi-regular participants.*

Results

Memory of Cafés

Perception of Experience

Alumni positively recalled their experiences with Café Sci – 69% indicated it had been “a very good experience” of their youth, as shown in the figure below. Only one person indicated it was one of the most important experiences they had. Only a couple of people felt it was less than great; and around 12% reported that they simply didn’t remember much about it a decade later.

When they explained their reasons for giving these positive ratings, two things came up most often – Café Sci was fun, and they learned about interesting topics. About one-third of commenters mentioned these two things (see the table to the right). In addition, around 20% of commenters noted the chance to meet and interact with professional scientists and that it was a social experience with other teens was part of how it created a positive experience.

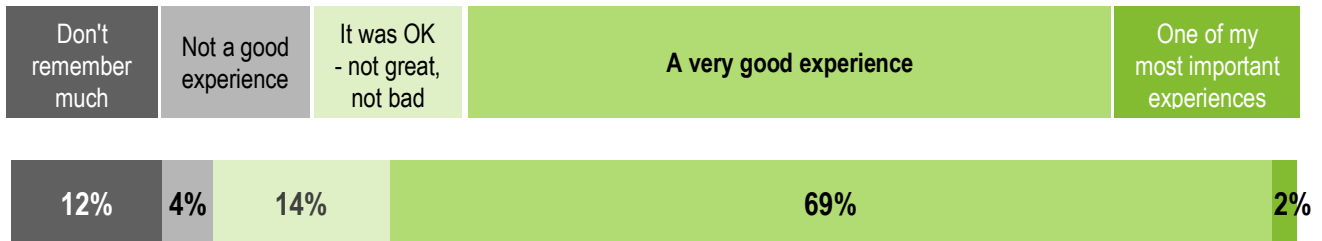
Other topics that emerged included were a handful who noted how Café Sci contributed to their career path (discussed in more detail later); appreciated its contrast with traditional science class in school; the value of being a Teen Leader; and the food or location being a positive part of the experience.

“It was really interesting to hear these different topics that you don’t really necessarily hear about in school and I think that’s why I continued to go.” (Focus Group)

Fun and learning about interesting topics were the two biggest reasons mentioned as why Café Sci was a POSITIVE EXPERIENCE. (n=38)

It was fun	32%
Learning and the topics addressed	32%
Hearing from scientists about real research	21%
Social: hanging out with friends	18%
Contributed to my career path	13%
Contrast with school science class	8%
Being in a leadership role	8%
The food and/or location	5%
Other topics	18%

Nearly 70% of alumni felt Café Sci was a very good experience of their youth, although most would not rate it as one of their "most important" experiences.



What They Liked Best

When alumni reflected more specifically about what they remembered liking most about Café Sci, three things rose to the top for more than one-quarter of respondents. **Alumni enjoyed Café Sci because of the combination of real scientists (talking about real research), learning about interesting topics, and that it was a relaxed, social experience.** As one survey respondent put it:

"Getting a glimpse at a variety of different speakers' interests and all the amazing things that are out there in this world to be explored or worked on. New information is invaluable, and exposure to something - even if the field is only a minor interest for me as an individual - is still one of my favorite things." (Alumni, survey)

These themes were repeated in the interview discussions with alumni. Each person found different strengths in the experience; with the aggregate suggesting that it was the mix of the authenticity of the scientists, the compelling topics, and the relaxed social environment that kept teens coming back.

In the qualitative data, all of the focus groups and interviews referred to the value of the opportunity to talk with real scientists and the authenticity of the research they shared. It was the most consistent theme and was often mentioned in discussing specific ways Café Sci impacted them, which is discussed more in a later section.

"As I went to [the Café sessions], I enjoyed them, I'm an engineer now, so I just enjoy working with my hands, building things, designing things; so just to see the different scientists and engineers that the lab presented was pretty cool." (Focus Group)

The social factor was often a reason that alumni first attended or kept attending the Cafés. Alumni noted that it was a friend who convinced them to attend or helped motivate them to keep coming.

"I think I really just went in the first place because a girl invited me to go and I was like, 'Yeah, sure I'll go,'" (Focus Group)

"I always had fun. It was a good time for me and some friends to get together and explore that geekier side" (Interview)

Alumni MOST LIKED Café Sci because it included real scientists, they learned about interesting topics, and it was a social experience. (n=45)

Hearing from scientists about real research	36%
Learning and the topics addressed	28%
Social: with friends; meeting new people	26%
Spending time with science-interested peers	10%
Being in a leadership role	8%
Getting extra credit	6%
Other topics	12%

In the focus groups and interviews, alumni helped interpret how these factors came together as the "secret sauce" of making Café Sci so effective. They described that **its value came from being a "casual" or "intimate" learning environment – a small group of friendly peers, food, and highly interactive and conversational with the scientist-presenters.** Together, these factors created the casual learning environment that worked for teens. Some noted how distinct this was from most other STEM-related experiences available to teens.

"For me it was the topics and the format and how it was very intimate, and everybody could kind of ask questions and have conversation, that was really nice." (Focus Group)

"I think people will more willing to ask questions than they were possibly in a regular classroom setting. ...They were just kind of honest and sincere, and they were just trying to understand, and I don't think people really judged them for their questions. It was just a good place to ask questions and receive honest answers." (Focus Group)

"A lot of the [activities] that are science or math related are like competitions. Or they're just clubs and there wasn't really anything interesting in that for me. So, it was cool having someplace where I could learn about very specific, interesting concepts but still do it in like a casual, friend way." (Focus Group)

Around 10% of survey responses revealed that the program provided a distinct social experience for some teens – that **Café Sci created a community of like-minded, science-interested teens**. These comments didn't focus on simply "hanging out" with friends, but that they particularly enjoyed being in a place with other teens who liked to talk about science. This theme was reiterated by several participants in one of the focus group discussions, however it was not as prominent in the other interviews and focus groups.

"I think the best part about it all in general was how it made it "safe" to be into science-y topics by connecting us with real professionals. Young people have a lot of pressures to hide what they're really passionate about but places like Cafe Sci helps grow these passions in productive ways. Also, honestly, I think it looked really good on my college applications!"
(Survey Response)

Alum 1: "The people that were there wanted to be there... so it wasn't just like a regular classroom, people messing around. They wanted to be there, they wanted to learn, and they wanted to actually talk about it afterwards and hear each other's thoughts and it was just a good experience overall. ..."

Alum 2: "You're right, people in the classroom just want to, they're just messing around; but at Café Scientifique, they are there because they want to learn something new, and that's really awesome to be around." (Focus Group)

Across the survey data, a small portion mentioned the opportunity for youth leadership as a highlight of the experience, but this theme arose more strongly within qualitative data, although it did not come up in every discussion. It was most significant for those who served as teen leaders, but not exclusive to them. When discussed, **alumni described the importance of how the adult leader(s) treated them – respecting their ideas and giving them meaningful responsibility**. It broke the traditional teacher-student power dynamic that they were used to.

"I found it very empowering in that these young people, some of them younger than I was, were having such an impact." (Interview)

"Honestly, it was probably mostly that they were adults who still treated the kids like adults." (Interview)

"Of all of the activities that I did in high school, a lot of them were just very by-the-book school activities, and this one was the most interesting – co-created. We were trying to figure it out as the organizers were trying to figure it out, every talk was something totally different and we didn't know what to expect from it. That was the most beneficial part for me." (Focus Group)

"The thing I remember was interactions with Jen, and I was really inspired by her. ...I just remember feeling she would take us very seriously. ...That made it feel accessible to me. And she was definitely someone I have thought about moving forward in my career – of that level of professionalism, but also just warmth; it's something that, as a leader, I think is important to strive for. So, I would say in that way she was sort of a role model for me." (Focus Group)

"I can remember so few details about anything about this whole thing. But I remember Jen, and I've wondered over the years, 'What is Jen doing? Why did she do that for us?' It was like, that was such a big effort that she was involved in. And it was very inspiring and baffling to me that this adult would be working with children to help them create something." (Focus Group)

Memorable Café Sessions

Even 6-10 years after last attending a Café, **one-third of the alumni reported that they could still recall at least one Café topic or presenter well.**

There was quite a range of topics that alumni recalled through survey responses and during interviews, including:

- Nuclear energy
- Nuclear proliferation
- Nanotechnology
- Lasers as weapons
- Cybersecurity
- Programming robots
- Research on explosives
- Mars Rover
- Extracting DNA

Most of these were just mentioned one time. During interviews, several of these were brought up again (likely by the same respondents), with most being able to recall either the hands-on activity or something compelling about the research or technology that was discussed.

One session did seem to stand out for multiple alumni, on the topic of nuclear proliferation. In addition to mentions in the survey data, it was raised by three people within two different focus group discussions. One alumnus emphasized how the topic has continued to interest him, referring back to the impact of that session throughout the discussion. He even reported that he had followed developments in this area and continued learning about it ever since this Café:

“The thing I remember most is [the] talk on nuclear weaponry. That one really opened my eyes, and it was really cool to actually hear from a professional that worked in that field about what was going on and what the capabilities were, and it really opened my eyes to that. I never really gave it much thought. And I've since gone on to take an online course offered by Stanford about it and learn a lot and I just thought it was absolutely fascinating and it was an important thing given the age we live in that maybe more people should be aware of.” (Focus Group participant)

One-third of alumni can remember a specific topic or presenter from Cafe Sci, 6-10 years after the program.



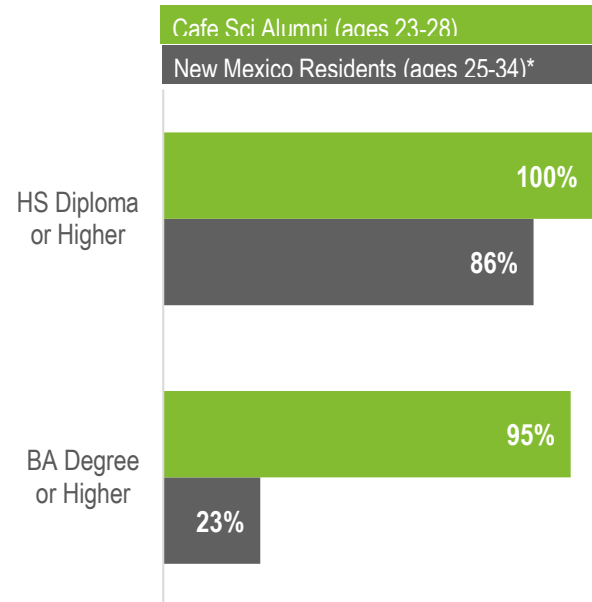
School & Career Paths

Schooling & STEM Studies

In addition to graduating from high school, **98% of Café Sci alumni have pursued post-secondary study and 93% had earned at least a bachelor's degree**, as shown in the figure at the bottom of the page. In addition, the majority (54%) have either earned or are currently pursuing a graduate degree.

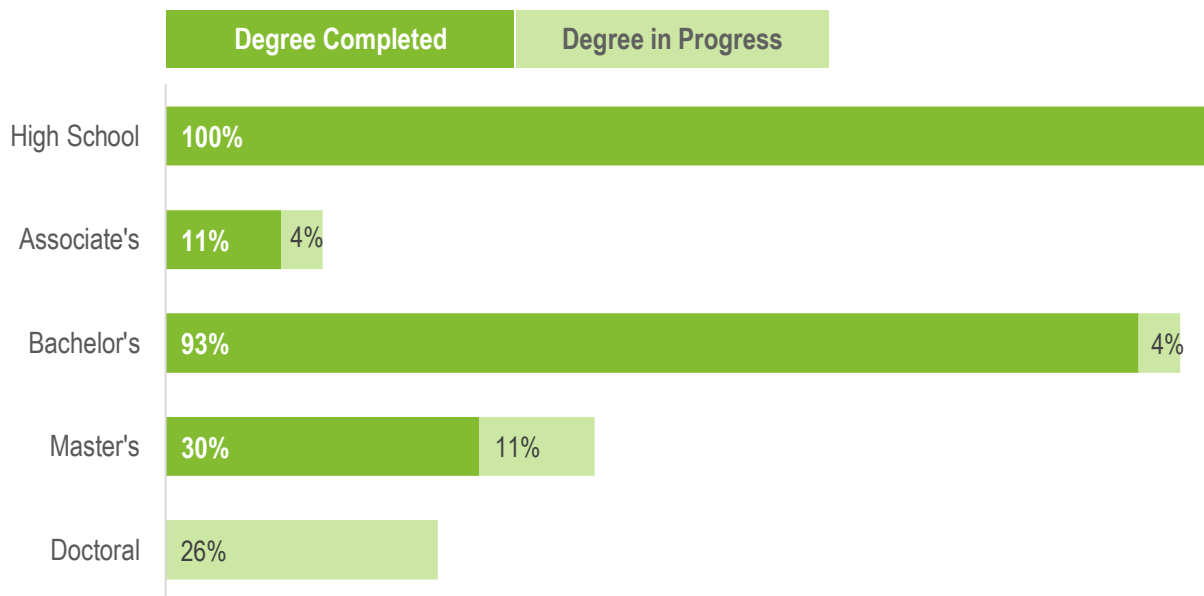
When we compare the alumni sample with census data for the larger population of New Mexico residents, we see that **Café Sci alumni have earned BA/BS degrees at a much higher rate than their peers in the state** – 95% for Café Sci alumni, but only 23% for their age group statewide. See the figure to the right for detail. Alumni also out-achieved their peers in terms of high school graduation rate, but with a much smaller difference.

Café Sci alumni have earned advanced degrees at 4 times the rate of their peers across New Mexico.



**New Mexico data from the US Census 2012-2016 American Community Survey 5-Year Estimates*

Nearly all Café Sci alumni have completed or are working toward their Bachelor's degrees; 41% of those have either earned or are working toward a graduate degree.



When we analyzed their reported major fields of study, we found that **the vast majority of alumni had pursued study in a STEM field.** 71% of alumni who pursued undergraduate degrees chose majors in STEM fields. Of the alumni who earned or are pursuing graduate degrees, 81% are in STEM fields.

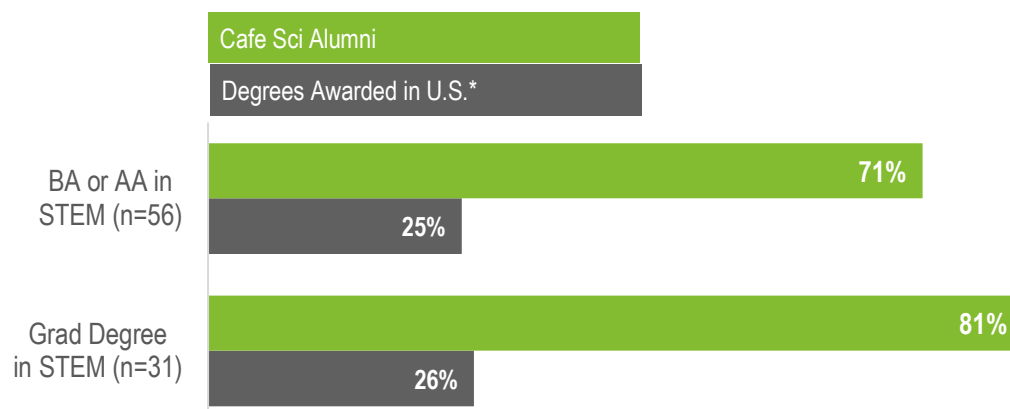
Among alumni pursuing undergraduate degrees, the most common STEM majors were engineering (36%) and the physical or life sciences (20%), as shown in the table to the right. Among non-STEM fields, alumni most often were social science majors (25%).¹ Fewer alumni pursued graduate degrees, but these were overwhelmingly in STEM fields. Again, most of these degrees are in Engineering (39%), with 19% of alumni pursuing advanced degrees in medical fields and 19% pursuing advanced degrees in physical or life sciences.

The figure below highlights that Café Sci alumni pursued STEM studies at far higher rates than is typical in higher education in the United States.

While it is typical that about 25% of the degrees awarded by U.S. institutions are in STEM fields, more than 70% of the degrees awarded (or being pursued) to Café Sci alumni were in STEM fields. While Café attendees are self-selected, and many attendees have previous aspirations to pursue STEM study, the contrast with national averages is striking.

Undergraduate STEM Majors (n=56)	71%
Engineering	36%
Physical or Life Sciences	20%
Mathematics	7%
Medical Fields	7%
Computer Science	5%
Undergraduate Non-STEM Majors	38%
Social Sciences	25%
Business	5%
Humanities	5%
Communication / Media	4%
Arts	2%
Education	2%
Graduate STEM Fields (n=31)	81%
Engineering	39%
Physical or Life Sciences	19%
Medical Fields	19%
Computer Science	5%
Graduate Non-STEM Fields	19%
Social Sciences	10%
Business	6%
Education	3%

The vast majority of Café Sci alumni pursued undergraduate and graduate degrees in STEM. This was a far greater rate than the proportion of STEM degrees that are awarded in the U.S.



*National data from NSF's Science & Engineering Indicators 2018; data represents proportion of total degree awards in STEM fields in 2015.

¹ Fields of study were coded using the Classification of Fields of Study in NSF Publication 15-321.

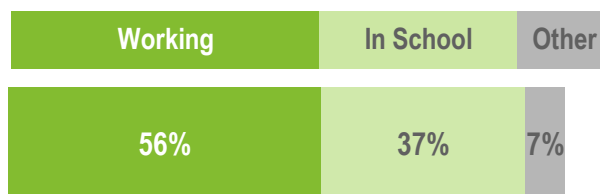
Careers & STEM Pathways

Just over half of responding alumni indicated that are currently employed full- or part-time, while another 37% are primarily in school (with a few also holding part-time jobs), as shown in the figure to the right.

When we analyzed the occupations held by employed alumni, we found that **around half of working alumni are in STEM careers**, the other half are working in non-STEM jobs. The table to the right shows the breakdown of alumni occupations. **The most common profession among alumni is engineering, an occupation held by one-third of working alumni.** Other STEM workers are in computer science, medical fields, physical or life sciences, or science education. It is worth noting that most alumni pursuing careers as physicians are still working toward their degree (as seen in the data in the previous section). In a few more years, it is likely that the proportion of alumni working in medical fields will grow. The other half of working alumni are in non-STEM fields, with Business professions most common.

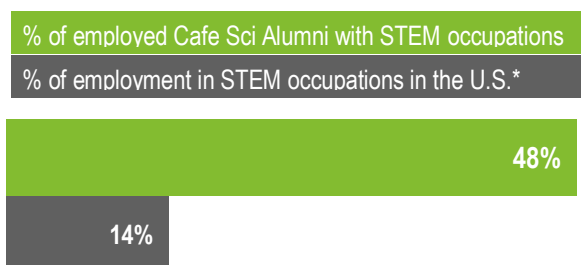
The figure below highlights that Café Sci alumni are in STEM professions at a far higher rate than is typical for American workers. While about 14% of U.S. workers were classified as working in STEM-related occupational categories,² half of the Café Sci alumni were in these fields. As with education statistics, the contrast is striking even knowing that Café attendees were a self-selected group with some degree of prior STEM interest.

Most Café Sci alumni are currently hold jobs; just over one-third primarily attend school.



Job in STEM Field (n=33)	48%
Engineering	33%
Computer Science	12%
Medical Fields	3%
Physical or Life Sciences	3%
Science Education	3%
Job in non-STEM Field	52%
Business	24%
Education / Teaching	9%
Social Services	6%
Arts, Design, Entertainment, Media	6%
Legal	3%
Military	3%

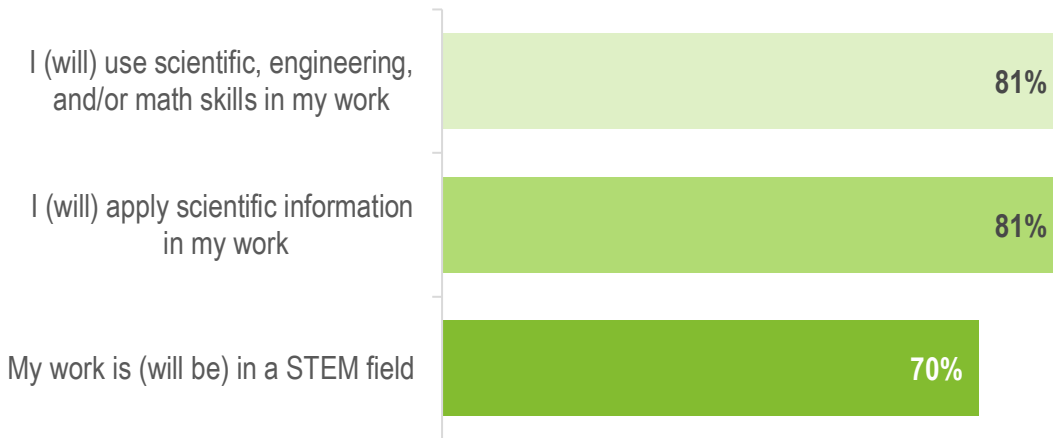
Around half of working Café Sci alumni are in STEM occupations. This is a far higher proportion than the number of U.S. workers overall in these fields.



*National data from 2016 Occupational Employment Statistics program, U.S. Bureau of Labor Statistics

² Occupational categories were coded based on the Department of Labor's Standard Occupational Classification manual.

For all alumni, 70% either already work in or are studying toward **STEM careers**. Even more alumni report that they do or will apply scientific information or skills in non-STEM careers.



When alumni self-reported about their current professions or their intended professions (for those still in school), **70% were in or intended to be in STEM fields, and even more reported pursuing work that required the use of scientific information or STEM skills, regardless of the field.** This included people who described professions in business within STEM-related companies (e.g., a business analyst for a wind turbine company); or jobs like market research, which fall within the business classification, but rely on STEM-skills of conducting research and analyzing data.

How Café Sci Influenced Alumni

In an open-ended question on the survey, alumni reported that there was some diversity in how each person felt Café Sci had influenced them. As shown to the right, **almost one-third of alumni said the Café gave them exposure to new ideas, concepts, and topics** they wouldn't have encountered elsewhere; these comments included alumni who contrasted their learning in Café Sci with what was covered in science classrooms at school.

"It was a good way to reinforce and expand upon what I learned in class. It's good to have more than just book studying and classroom stuff for science exposure." (Survey response)

"Frankly the thing I remember most and from conversations with my peers was that it was one more thing exposing us to the world of science. Many of my friends already had this possibility, but the format was what made cafe effective (and the extra credit as incentive)." (Survey response)

While many alumni had some level of interest in science when they started attending Café Sci, **about 22% described its influence as having built, refined, or reinforced their interest in STEM** – including building STEM interest without needing to pursue a career in these fields.

"Café Scientifique showed me that science can be fun, hands on, and related to everyday things. I like seeing how science is part of normal life." (Survey response)

"Again, things like Cafe Sci made it "ok" to be into science and made it accessible and interesting, and it wasn't a huge lift to be involved with. I think it's essential to treat young people like adults and challenge them with tough topics and connect them with real working people." (Survey response)

"I think it just made me more interested in science at the consumer level of things--I don't really consider myself "smart" enough or math-minded enough to be a scientist in my career, but I love learning about that stuff regardless and I appreciated the cafes because they were easy to follow and understand!" (Survey response)

Exposure to new STEM ideas and topics	29%
Built or reinforced interest in STEM	22%
Generated or reinforced interest in STEM study or career	20%
Building non-STEM related skills or interests	13%
Aware of (local) STEM careers/research	11%
Developed friendships	7%
No specific influence came to mind	24%

And **about one in five of alumni who answered this question reported that the program had influenced their STEM career interests** to some degree. This was sometimes sparking interest, sometimes reinforcing interest, and sometimes highlighting how these careers would impact the world around them.

"Cafe Scientifique definitely influenced my decision to pursue research opportunities in college, first working as a lab assistant and then conducting my own research for my thesis." (Survey response)

"At the time it gave me motivation to pay more attention in science classes, it was an introduction to a topic I didn't know I was interested in." (Survey response)

"I already was pretty convinced I wanted a scientific career path, but Cafe Scientifique helped reinforce that choice. I think it made science more attractive as a career since we got to learn about interesting problems people were working on." (Survey response)

Other areas of influence included building non-STEM skills, awareness of STEM careers that existed (especially locally) and developing lasting friendships. Finally, **about one-quarter of survey respondents stated that they couldn't think of any specific influences** Café Sci had on them.

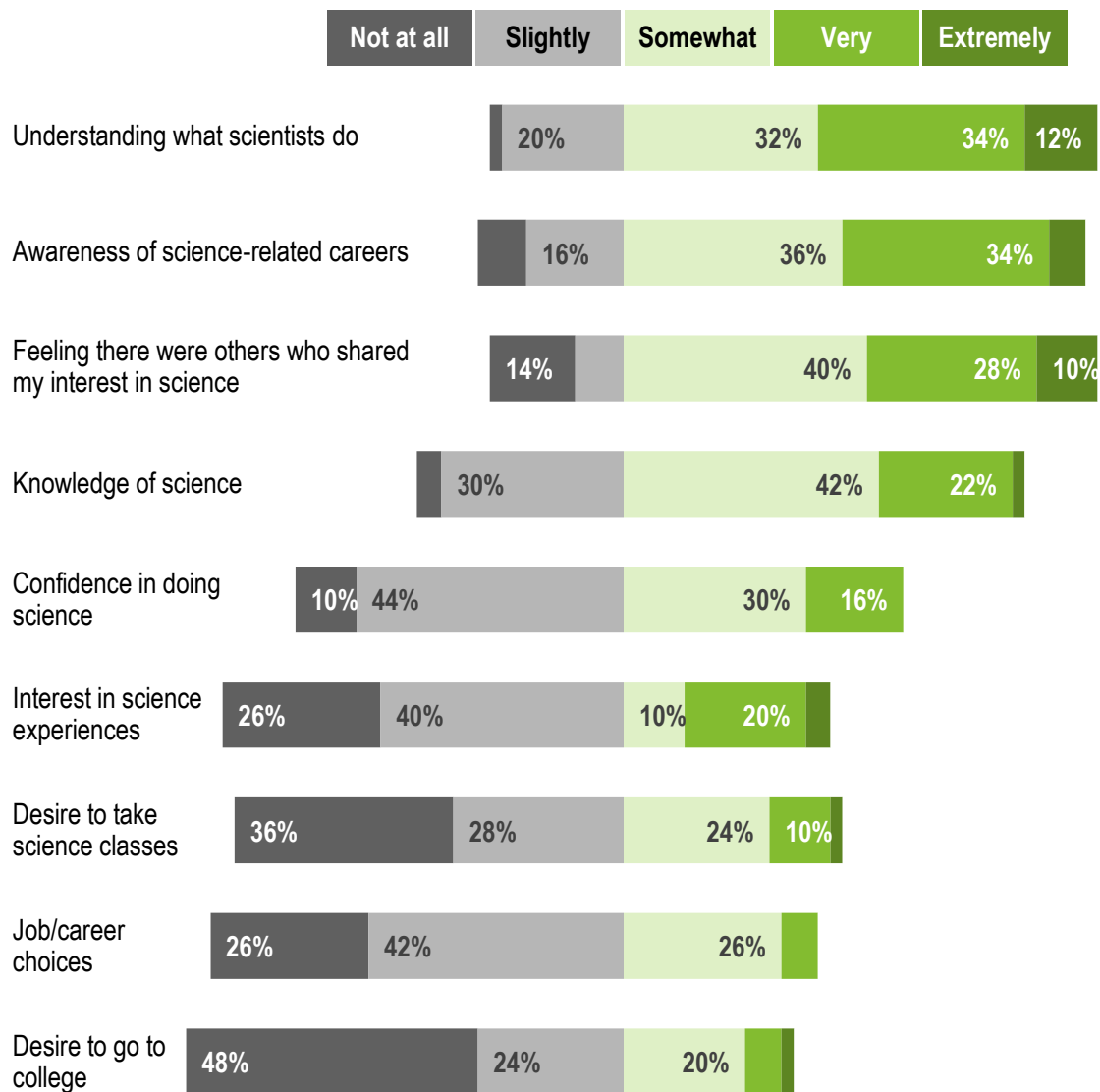
These areas of influence are explored in greater depth in following sections.

Strongest Areas of Influence

There were four areas where the majority of alumni felt Café Sci had been “very” or “somewhat” influential, as shown in the figure below. These results indicated that **most alumni felt Café Sci had some influence on understanding of what scientists do; awareness of science careers; feeling part of a science-interested peer group; and knowledge of science.** In general, however, alumni didn’t identify the Café Sci as having been “extremely influential” on any aspects of their lives.

In response to the other areas explored in the survey, the majority of alumni felt that Café Sci had only been slightly or not at all influential on them. These items were more focused on academic and career-related outcomes, such as the desire to go to college (many were already college-bound), career choices, or interest in science classes or non-school science experiences.

The majority of Café Sci alumni felt that the program was somewhat or very influential on their understanding and awareness of science, scientists, and science-related careers.



Café Sci vs. Other Youth Experiences

When alumni were asked to reflect about the ways that different youth experiences each contributed to their development, relative to one another, the data created a picture of which experiences had relatively stronger and weaker levels of influence in the lives of teens. The question asked alumni to think about seven types of influence (from helping them understand the research process to helping them recognize their own strengths and weaknesses). For each one, alumni had to distribute 20 points between seven possible influential factors – including Café Sci, school, family, friends, and other activities.

From these data, we computed the average number of points assigned to each factor within each type of influence. The heat map below depicts the relative strength of influence each factor had for the teens. **In general, alumni felt that school and family had the strongest influence on them in most areas, including understanding research, feeling confident in science, and figuring out their career path. Friends were most influential in learning to respect different ideas.**

Café Sci experiences tended to have relatively lower influence on teens than school or family, but generally stronger influence than other STEM activities, sports, or other non-STEM activities. **The areas where Café Sci had some influence were mainly about understanding scientific research, finding connections between science and their own life, and feeling confident in science.**

School and family had the strongest influence on youth development in nearly all areas. Café Sci had some influence on science understanding, confidence, and personal connections.

How much did each of these places/people help you...	n	Café Sci	School	Family	Friends	Other STEM Activity	Sports or Activities	Something Else
Understand the process of scientific research	46	3.9	5.0	4.0	2.0	1.0	1.0	1.0
Find connections between science and my own life	45	3.6	4.0	4.0	2.0	2.0	1.0	1.0
Feel self-confident in science	45	3.3	5.0	4.0	2.0	1.0	1.0	1.0
Respect people's ideas that are different than mine	47	2.1	4.0	4.0	5.0	1.0	1.0	1.0
Figure out my career path	46	1.7	5.0	4.0	2.0	1.0	1.0	3.0
Feel I had a positive future ahead of me	47	1.4	4.0	5.0	2.0	1.0	2.0	1.0
Recognize my strengths and weaknesses	47	1.1	4.0	4.0	2.0	1.0	2.0	1.0

Avg. Points:

Little to None: 0 - 1.9 pts

Some: 2 - 3.9 pts

Substantially: 4 - 5.9 pts

Extremely: 6 - 7.9 pts

Influence: It Made Science Real

One of the most common things expressed across most of the interviews and discussions reinforced the data shown on page 15 – that Café Sci had great impact on helping youth see understand what scientists do and the careers that are out there. Across the qualitative data, **alumni tended to describe that Café Sci had made science very tangible or real for them.** These comments often referred to the stark contrast between school science (a collection of facts and rote experiments) and Café Sci, which revealed the complexity, applications, and passion of the people who pursue it. These comments emerged regardless of prior science interest in the alumni; even for some who knew their future was in science, Café Sci was often the first revelation of what that really meant.

"I didn't have any scientists or engineers in my family, so... it was this very theoretical concept to me for someone to be doing research into some scientific field. It was totally something I'd only seen in books or on TV. So, I think the biggest thing that Café Sci did to change or affect my way of looking at science was seeing the people and the process behind it. Outside of heavily edited PBS documentaries about [science topics]... that was kind of my exposure." (Focus Group)

"You talk about building blocks to science in high school, the things that make it work and I think the Café was how it all comes together in its finished form or product." (Focus Group)

"Coming into it, my only experience to science before then was sitting down in a classroom that I didn't necessarily want to be in. But then my choice, my option to be there and checking out all this cool stuff that's happening, it was just incredible for me. Being able to get my hands really on it rather than just the theory of it was a really big game changer for me." (Interview)

"The science classes that I remember were very much, 'We're going to teach you established principles,' and... that, of course, is not the case with Café Scientifique. It was very much about what is currently being developed, and that's something that we didn't get to talk about a whole lot in science classes in school." (Interview)

Influence: Perspectives on Science

Quite a few alumni also described a range of other ways that Café Sci influenced their perspectives on science during discussions. For some, it was having developed **a new view on a topic that persisted** – such as nuclear proliferation or crime scene investigation. One alumna noted that Café Sci was her first exposure to a scientific talk. And for at least one alumnus, he felt that **the Café had been an important part of, effectively, building a strong science identity** that supported their lifelong interest in science even though they did not pursue STEM careers.

Alumni who had a great deal of other science exposure in their youth – through family, research internships, etc. – tended to not feel this was an impact area for them.

"The CSI talk did give me a new perspective on how to view TV shows and view what we see in the media, and it was, I guess, an indirect influence in my life, and I still question what really happens." (Focus Group)

"I definitely learned a lot from each of those events, especially because I didn't pursue a science field in undergrad and I didn't take any science classes, so high school and these Café Scientifique's were the most science that I had been exposed to." (Focus Group)

"I actually did not become a scientist at all; and I thought I wanted to be one when I was in high school. And I think maybe, I don't wanna place too much of a retrospective lens on this, but, what Café Sci did was, I think make it okay for me to be literate and interested in science without it having to be my all-consuming passion.

One distinct thing I remember from going to these things was how dedicated the people we heard from [the scientists] were to the really, deeply specific things they were working on in their science and engineering fields. And I think it honestly might've precipitated this, 'Wow, maybe I don't want to do that with my life.' But I still really care about understanding the basics of science or staying literate or being able to read the news and know what they're talking about, or [that] being able to research things on my own are important, feasible, doable things. Because behind it, it's just like normal people I've seen talk before." (Focus Group)

Influence: On Career Path

As seen in the survey data, **many interviewed alumni felt that Café Sci had not had a significant impact on their career trajectories** or interests. In most cases, these individuals had already figured out what field they wanted to pursue – whether in or out of STEM – and there was not much room for Café Sci to influence them.

"I knew that [specific field of] Engineering was the place to be for ages, before elementary school. But I did love the Café. I want to say that it changed my life and sent me on that path, but I was there before." (Focus Group)

But **several others did reflect on ways that they felt Café Sci had influenced them toward a STEM career**. It was not often that a Café inspired their passion for a particular topic, but that it made the work of scientists tangible, so that it suddenly seemed to be a real possibility for their lives.

"For me the casual atmosphere with a scientific professional, with someone who was an expert in their field made the science and the idea of actually becoming a scientist far more tangible for me. I didn't know a lot before [Café Sci], and now I'm in grad school for chemistry and that definitely made it seem tangible. ...I think that definitely affected my career path. ...You read in books and ...it's some old dude in the 1800s with a beard that does chemistry, like that's who [a scientist] is. Meeting actual scientists and engineers that are currently doing science on topics that are all around us, labs were usually local that provided the scientists. It made it seem, 'It's like something I could actually do.' Yeah, it made it seem more real." (Focus Group)

"That exposure, it was life changing for me, honesty. So just knowing that these things are out there, and I can do them, huge. ...Because, I mean, I came from a lower economic background and that just didn't seem possible. Like, School? I know that's out there, but I'm never going to touch it. So, the idea that, yeah, I can, with the right resources and with the right people, the right guidance, I can absolutely be in that position. In that sense it was life changing." (Interview)

"It kind of opened my eyes to things I didn't even know were out there that just... because we were all in high school, in our own little bubble not really knowing what kind of career possibility, not really thinking about that when you're in high school. And it just kind of opened my eyes to what was there, and it just gave me more background knowledge going into college, which helped because I feel in college it's kind of fake it until you make it." (Focus Group)

Interestingly, one alumna reflected on how her **experiences as a teen leader helped her clarify her interest in particular types of work** – such as project management and planning – rather than an interest in a particular field or content area:

"I did not end up in a scientific field, ... but when I reflect on my experiences, what I remember most are those planning sessions. And I think that that's pretty telling in terms of what I do now [in my job], [which] is a lot of project and people management, and a lot of strategy and planning and focusing on process. And so, I think I was realizing that through the leadership involvement with Café Sci, that that was an interest to me, perhaps more than the subject matter itself." (Focus Group)

One other alumna reflected on how the experience impacted their current work in recruiting and hiring for a STEM-related company, where an emphasis has been placed on increasing diversity on staff.

"Having that casual space [of Café Sci] and friends that were encouraging and willing to go along with it and do it with me and stuff, how impactful that was. And how different it would be for someone who doesn't have those structures in place to make it feel okay to be curious about science, or whatever it is they want to be curious about.

So I guess now as I'm a person who has to recruit people to do things, or go to universities and talk to people, and hire people, I'm now thinking more about all of the little steps that happen along the way before you even get to the point of forming your idea of what your career is. That just sort of unlock curiosity and unlock ability and give you permission to follow the path that you want to follow." (Focus Group)

Influence: Science Outreach Activities

In two of the focus group discussions, it emerged that **a few of the alumni who are in STEM-related fields are now encountering opportunities to engage in outreach activities** themselves. These alumni noted how they have thought back to their Café Sci experiences – and imagining what the scientist-presenters must have done to prepare for such interactive, engaging sessions with teens.

"I know with my current company we have forty hours of paid time a year to do STEM outreach, so I actually got to participate my first year here at a STEM outreach in a middle school. And as we were kind of doing the activities with the kids, I kind of thought back [about] what made me interested in high school in the Café Scientifique and things like that. And so it helped me." (Focus Group)

"I'm giving a presentation to some high schoolers in like a month or two about [my work], I would maybe try to do it in the same format and try to appeal to them, in the same way ... try to do it in the same format that caught my interest when I was in high school." (Focus Group)

"Being in science now and going to a lot of conferences and stuff, remembering the kind of seminars we would go to [at Café Sci] and how distinct they are from the seminars we see now. But it's the same subject matter presented in such a different way. It gives me a lot more respect for those scientists that gave those talks and made them so affective for a high school audience." (Focus Group)

Influence: Other Skills & Mindsets

Qualitative data also revealed a number of other ways that Café Sci influenced alumni in their later lives – including **the development of various skills and mindsets that were important in lives and jobs far into the future**. Some examples include:

Early experience in networking skills:

"One of the ways that it influenced me was being around other people that were also interested there; it was a first taste of networking kind of a thing. It's a group of people that are from all over the place and you get a chance to talk with them and I think, for me, it was a really valuable way to do networking in a casual kind of situation, but there was not like super high stakes kind of like at a career fair type of place." (Focus Group)

Early pride in accomplishment and belief in what they were able to achieve:

"I remember feeling proud of how all of those little actions added up to something that could affect a lot of people. I never really like organized anything outside of like a party for me or my friends or something, so that was pretty cool." (Focus Group)

Commitment to volunteering:

"I think the experience of volunteering and it being such a positive experience has kept me volunteering for other things throughout my college career so that's why I've continued being volunteering time, so I think that could've been a positive reinforcement for continuing that kind of stuff." (Focus Group)

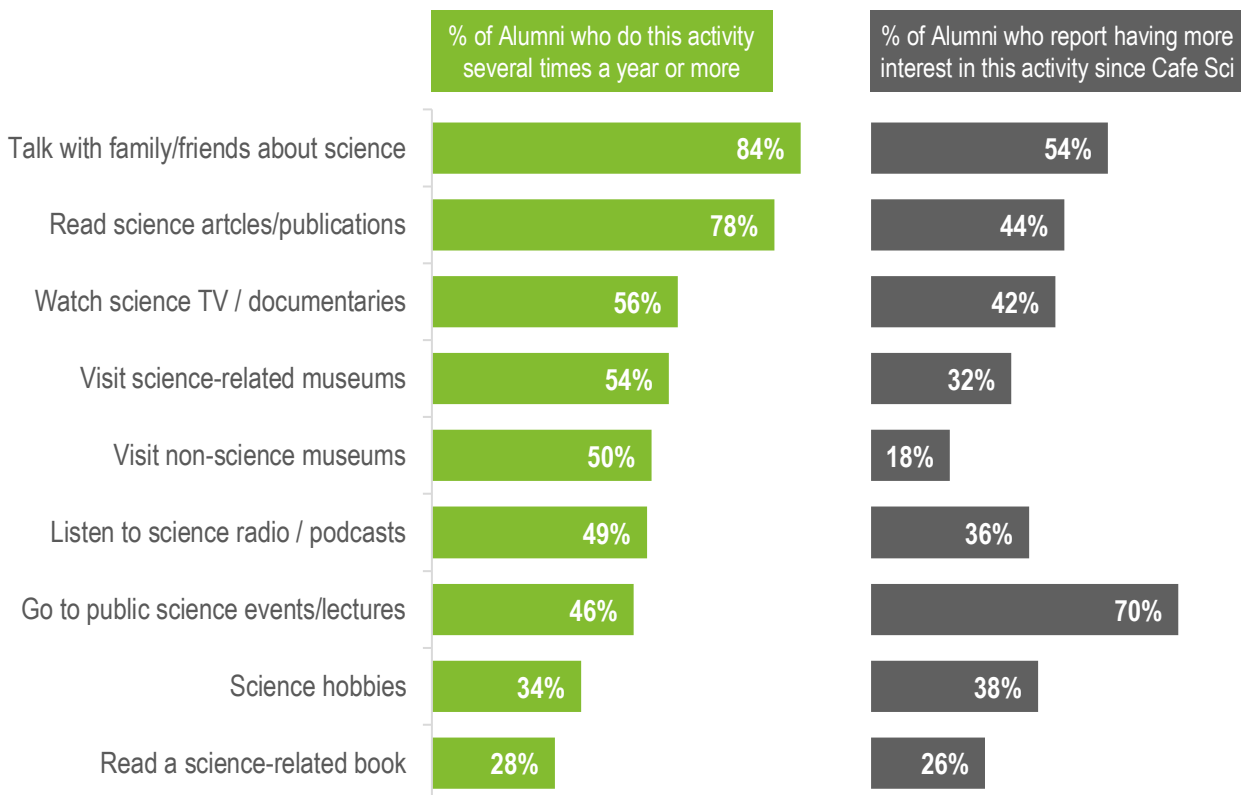
Life-long Learning Activities

On the whole, alumni have remained fairly engaged in lifelong learning activities, particularly related to science. **The vast majority of alumni report that they often (multiple times per year) talk with family and friends about science and read science-related articles** (online or in periodicals). The majority also often watch science-related TV programs and visit science museums. Around half often visit non-science museums, listen to science podcasts or radio, and go to public science events or lectures. The only less common activities were reading science-focused books and engaging in science-related hobbies. A detailed breakdown of their ratings is on the next page of the report.

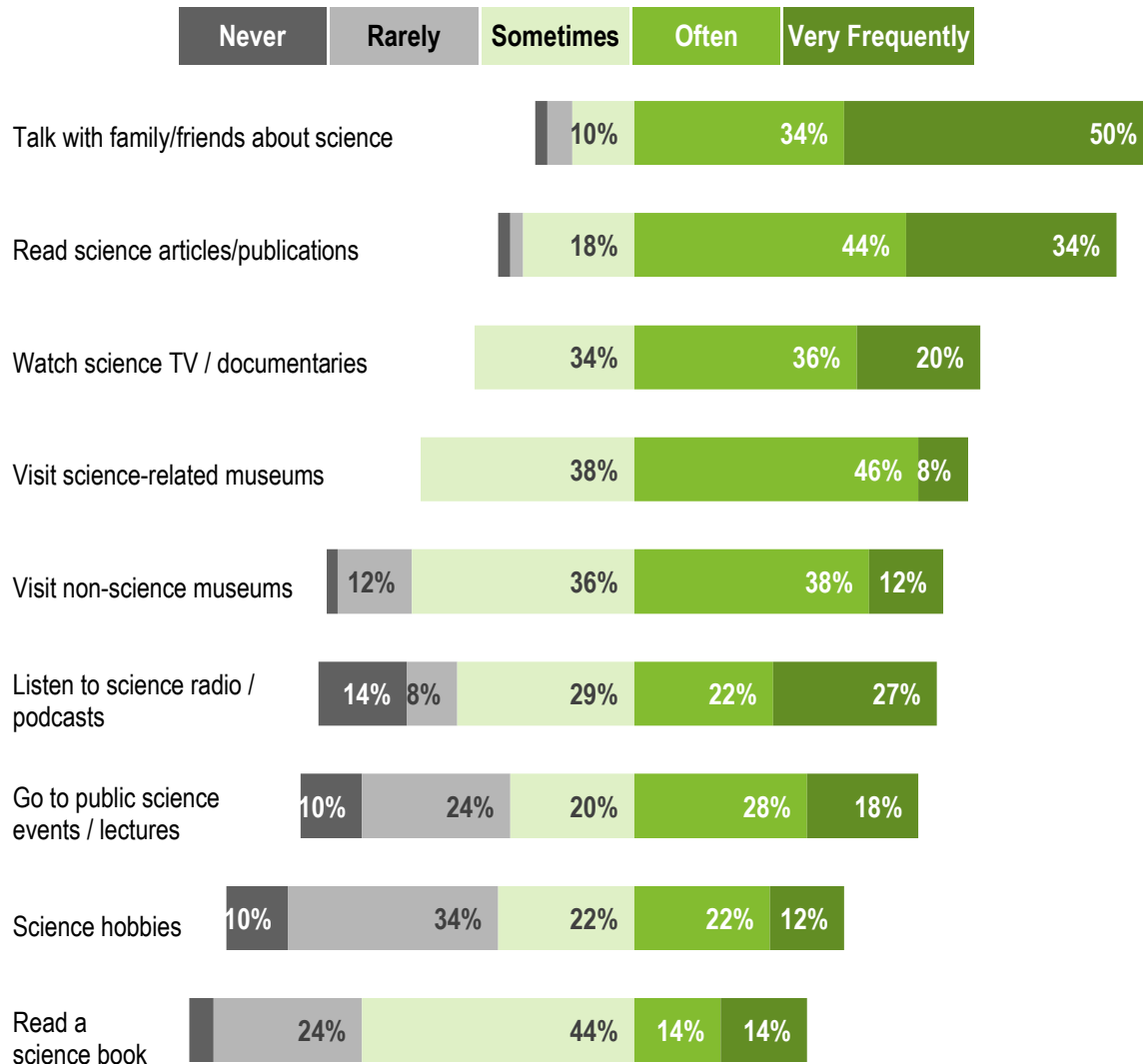
We also measured alumni’s retrospective sense of how much Café Sci influenced their interest in doing these types of lifelong learning activities. We asked alumni to rate whether they had more, less, or about the same interest in each activity after being involved in the program. A summary of results to both questions are side-by-side in the figure at the bottom of this page.

Results showed that **70% of alumni felt Café Sci increased their interest in attending public science events and lectures** – the lifelong learning experience most similar to the Café Sci format. The majority of alumni also felt that they were generally more interested in talking with family and friends about science after participation. This was followed by just under half who felt they were more interested in reading science articles or watching science TV programs after Café Sci participation.

Most alumni regularly engage in lifelong learning activities; of those, the majority feel that Café Sci increased their interest in science events/lectures and talking about science topics.



Alumni **most regularly participate** in several, science-related lifelong learning activities, including talking about science with others and reading science-related articles.



Comparisons by Subgroups

Exploratory analysis compared the quantitative data about how alumni felt Café Sci had influenced them to see if there were any relationships between influence and other variables – such as serving in a teen leader role, gender, or prior interest in science.

On the whole, there were not dramatic differences between sub-groups of alumni within this sample; largely, the patterns of how Café Sci influenced people was consistent across the sample. There were, however, a few areas where we saw differences on individual items for particular variables.

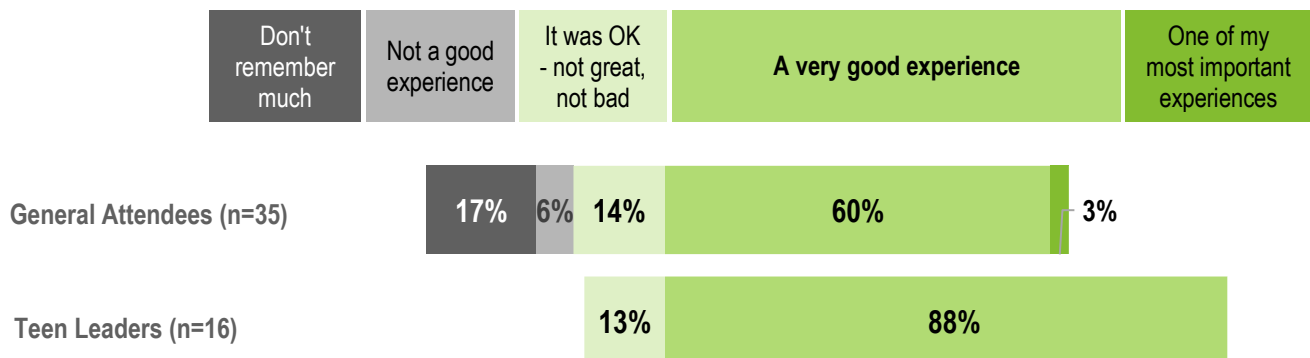
Teen Leaders

Although we anticipated that former Teen Leaders may report stronger influences of the program, **the data generally showed that former Teen Leaders reported similar levels of influence as general attendees.** Based on what was learned in the interviews, the additional impact that came from being a Teen Leader seemed to be more related to the building of “soft skills” of leadership and professionalism, rather than about science interest, career path, or understanding the process of science. These were not the primary areas measured in the quantitative survey data.

There was a slight, but noticeable, difference between Teen Leaders and general attendees in their ratings of the overall experience of Café Sci, as shown in the figure below. In general, **former Teen Leaders were more likely to report that Café Sci had been a very good experience;** although the majority of general attendees gave this same rating. In contrast, all of the alumni who reported they “didn’t remember much” about Café Sci were from the general attendee population. Clearly, being a Teen Leader made the experience more memorable for alumni, even after 10 years.

Statistically, the difference was substantial, but with the small sample did not quite reach the significance threshold of $p < .05$.³

Teen Leaders seemed more likely to report Café Sci was a **very good experience** of their youth, and general attendees were more likely to report they didn't remember very much about Café Sci.



³ Mann Whitney: $W=210$, $p=.085$, Mdn for Teen Leaders = 4, Mdn for General Attendees = 4.

Other STEM Activities in HS

In some of the qualitative data, we heard that alumni sometimes felt that the impact of Café Sci was limited for them because of their strong, pre-existing interest in science and/or because they had other STEM-related experiences at the same time that were, perhaps, more impactful. Mostly these comments referred to students who had internships in research labs. To test that relationship, responding alumni were grouped based on whether they reported being involved in other STEM-related activities in high school; this was a tangible proxy for pre-existing science interest and involvement at that time.

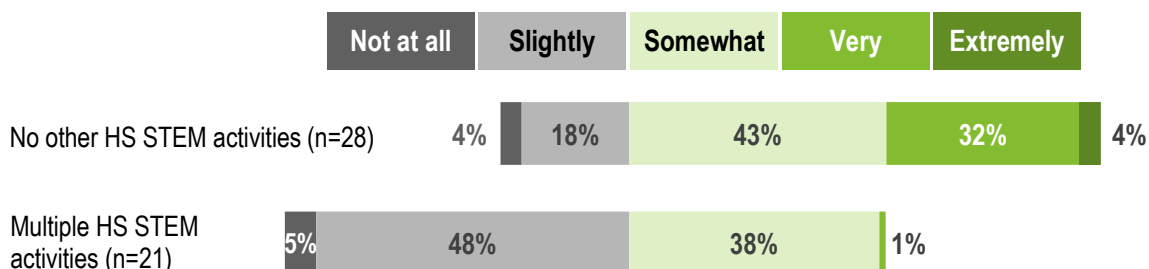
In many of the measures, the two groups gave similar self-assessments of the impact Café Sci had on them. However, **there were four items to which alumni who had not participated in other STEM activities reported significantly greater impact** than the alumni who had other STEM experiences in high school:

- Influence on their knowledge of science;
- Increase in their interest in reading science articles;
- Increase in their interest in talking about science with friends and family;
- Increase in their interest in watching science-related TV or documentary programming.

The figure below shows the difference in distribution of responses about how much Café Sci influenced their knowledge of science. Those who participated in other STEM activities tended to find it only “slightly” influential, while **those for whom Café Sci was their only STEM activity found it to be “very” or “somewhat” influential on their knowledge of science.**⁴

The figure on the next page shows the differences on the last three variables of significance. That figure shows the proportion of alumni who reported they felt they had more interest in doing each activity as a result of Café Sci participation, comparing those who had done other STEM activities in HS and those who had not. The results showed that for these three activities, only 24-28% felt they had greater interest after Café Sci, while **58% to 75% of alumni who had not done other science activities found they had greater interest in these activities after Café Sci.**

Alumni who were not involved in other STEM activities in high school found Café Sci to be much more influential on their Knowledge of Science than those who did multiple STEM activities.



⁴ A table presenting statistical results is available on the next page.

Percent of alumni reporting they had MORE interest in the following activities after being involved in Café Sci.

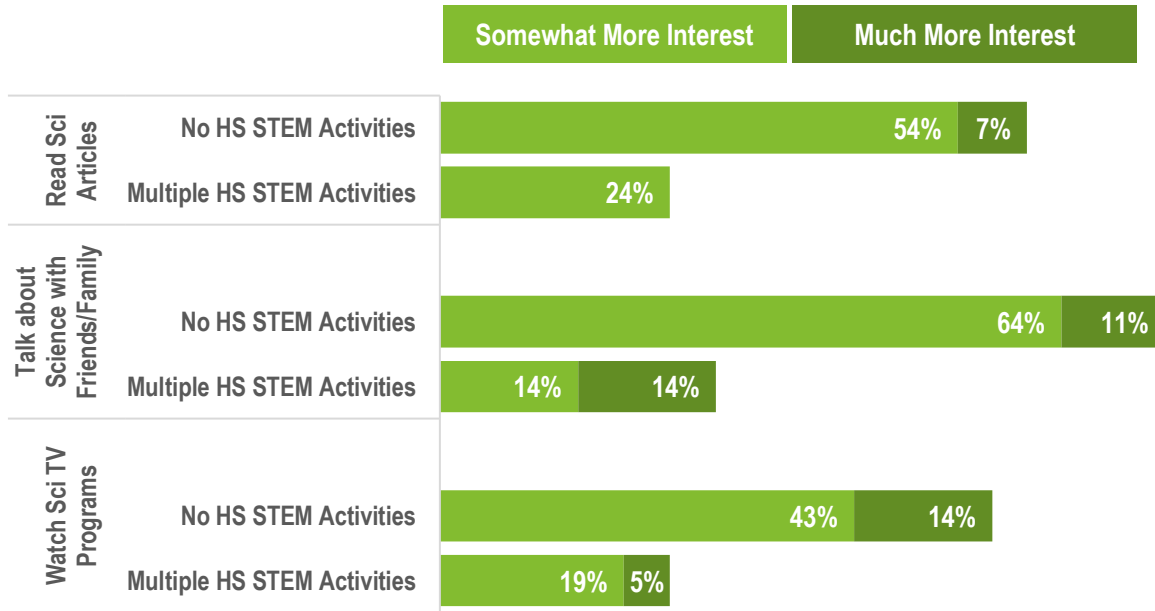


Table 1. Results from non-parametric comparisons (Mann-Whitney test) of ratings between those who had participated in multiple STEM activities in HS and those for whom Café Sci was their only STEM activity. (Only significant differences are shown.)

Item	W	p-value	Median	
			Only Café Sci	Multiple STEM Activities
Café Sci's influence on my knowledge of science	411.5	0.012	3	2
Greater interest in reading articles about science after Café Sci	413	0.007	4	3
Greater interest in talking about science after Café Sci	408	0.012	4	3
Greater interest in watching science TV programs after Café Sci	394	0.023	4	3

Demographic Variables

There were no substantial differences in how alumni reported the influence of Café Sci based on gender, the town where they attended Cafés, or based on whether their parents had STEM professions.

Because most alumni came from families where at least one parent had a bachelor's degree or higher, it was difficult to make comparisons based on this variable. When we compared results based on alumni whose parents had a master's degree or higher, there were not substantial differences.

Discussion & Conclusions

Most alumni recall Café Sci as a positive experience and attribute that its impact came by creating a casual, welcoming environment to learn from and interact with working scientists.

More than 70% of the alumni surveyed recalled Café Sci as a “very good” experience (or better) from their youth. While only one person recalled it as “one of the most important” experiences they had had, the clear majority still described it as having been fun, social, and an opportunity to learn about interesting topics and to meet working scientists.

In looking at what parts of the experience that alumni liked best about the experience, both qualitative and quantitative data indicated that Café Sci’s power came from a suite of structural features that created a teen-centered, casual, intimate learning environment. This meant that survey data did not point at one singular element that alumni recalled as what they liked best, but a set of attributes. And interview data expanded on these thoughts, as alumni articulated how these characteristics combined to create an environment that was truly unique in their community. The cafés were casual events (time and space for socializing, food, other incentives); they were small groups of peers who were there by choice – either interested or at least mildly curious about science; and they allowed for direct interaction with the scientists, who were talking about real research and its application. This experience contrasted sharply with school science, and as one interview noted, it contrasted with other available STEM after-school experiences – which were either competition formats or intensive research experiences in a lab.

While most of the alumni had positive recollections of the experience, the data suggested that the former Teen Leaders had stronger and slightly more positive recollections of their experience. Interestingly, however, this was the only impact area in which former Teen Leaders seemed to have a substantially different reaction than general alumni. Qualitative data suggested that the Teen Leader role may have provided unique impacts that were not directly STEM-related – such as development of “soft skills” of leadership, organization, planning, and confidence in one’s own abilities.

Alumni have pursued STEM study and careers at rates far higher than national averages, but only around 20-25% attribute Café Sci as having influenced those pathways.

The vast majority of Café Sci alumni majored in STEM subjects at the undergraduate or graduate level; and of those who are already holding jobs, around half are in STEM fields. This number will be higher in the future, as students pursuing advanced degrees (e.g., MD or PhD) are still completing their education. These rates far outstrip national averages – where only about 25% of degrees awarded and about 14% of jobs held are in STEM fields.

Many of these alumni, however, do not directly attribute their Café Sci experience to substantially shaping this outcome. Only about 20% of survey respondents described Café Sci as having helped shape, reinforce, or clarify their aspirations for STEM study or careers. And around 26% rated it as “somewhat influential” in this area. Based on interview data, we understand that many students came to the experience with well-established goals for a (sometimes very specific) STEM career. For these students, however, Café Sci gave them different benefits, such as giving them their first exposure to what it really meant and looked like to do science as a professional.

Another interesting influence on career paths were a handful of alumni who revealed in the interview data that they felt the experience had influenced other aspects of their current professional lives. For example, a former Teen Leader saw that the experience had helped reveal her interest and skills in project and people management, which is where her career has taken her. Another found that Café Sci helped him reconcile that he could still be a science-interested, science-knowledgeable person without pursuing a science career – essentially, that it was OK to love science but not make it your life’s work. And a couple of current STEM professionals noted how they are thinking back on Café Sci as they are beginning to engage in STEM outreach activities, now as the scientist-presenters. These examples point to the diversity of personalized ways that the Cafés have professional impacts.

Overall, it seemed that the greatest influence Café Sci had was in making science seem tangible and real for teens, while supporting them in developing an emerging science identity.

Among the ways that Café Sci might have influenced an alumnus/a, two that had most resonance for alumni related to improving their understanding of what science was and how it worked in the real world – understanding what scientists do and an awareness of science careers. These themes were strongly echoed in the qualitative data, with alumni describing the experience as having made science more “tangible,” and contrasting it profoundly with the way they were learning school science. This was consistent regardless of whether individuals were already on the STEM-career pathway before they came to Café Sci or not. The interactions with real, working scientists, who demonstrated their passion about their work and the relevance of how this work would impact the world was starkly different than learning concepts and conducting routine experiments in high school.

The other area of impact that emerged seemed to be in the ways Café Sci helped support and nurture individuals’ emerging science identity. The critical factor here seemed to be that Café Sci brought together a small group of like-minded, interested teens. The other statement that a more alumni tended to rate as having been very influential was “feeling there were others who shared my interest in science.” In the qualitative data, alumni better described why this was so important for them. Some drew the contrast, again, with school science classes; at Café Sci, everyone was there by choice and it made the learning environment better. Some described how Café Sci, and this group of their peers, was critical for developing a sense that it could be socially acceptable to be into science – something that can be difficult for adolescents; one example highlighted how having that casual, safe entry-point to science may have been critical in his journey.

And for a few, there have been individual Café sessions and topics that have stuck in their memory all these years later. Interview data revealed that this had the potential to cultivate a lifelong interest or attention to a topic – such as one alumnus who has continued learning about a particular field (that is not his career) because of an interest sparked at Café Sci.

Data suggest that Café Sci may have had greater influence on those students for whom Café Sci was their only STEM-related activity in high school.

While there were very few differences between subgroups of alumni on most of the measures, we found the most significant differences to be based on whether the alumni had been involved in other STEM activities in high school, beyond Café Sci. The differences were only on a handful of variables, but they were fairly stark. For instance, alumni for whom Café Sci was their only STEM-related activity reported that the program was much more influential on their knowledge of science. They also were more likely to report that they felt Café Sci prompted them to be more interested in several STEM-related lifelong learning activities, including reading science articles, talking about science with friends and family, and watching science-related television programming.

This supports some of the qualitative data we obtained, where we heard from alumni who had other, rich STEM-related experiences. These alumni frequently noted that they felt like there were limits on how much Café Sci had impacted them because they were already immersed in a lot of science learning – whether from parents who worked in STEM to two alumni who did work in research labs while still in high school. In contrast, alumni for whom Café Sci was their only non-school science experience could better point to the benefits of Café Sci at exposing them to ideas and information they would never have seen otherwise. As one interviewee, who had not pursued STEM study, noted – Café Sci was the greatest amount of science he’d been exposed to, outside of high school classes. While this type of program has value for many of its participants, it seems that its welcoming, casual, social environment has the potential to be particularly influential for the students who would not otherwise get involved in traditional out-of-school STEM activities and/or who may not be on a STEM career pathway.

References

- Hall, M. K., Foutz, S., & Mayhew, M. A. (2013). Design and Impacts of a Youth-directed Café Scientifique Program. *International Journal of Science Education, Part B, 3*(2), 175-198.
- Linzer, D. & Munley, M. E. (2015). *Room to Rise: The Lasting Impact of Intensive Teen Programs in Art Museums*. Whitney Museum of American Art: New York, NY. [technical report]
- McCreedy, D. & Dierking, L. D. (2013). *Cascading Influences: Long-Term Impacts of Informal STEM Experiences for Girls*. The Franklin Institute: Philadelphia, PA. [technical report]
- Sickler, J. & Johnson, E. (2009). *New York Hall of Science: Science Career Ladder Retrospective Impact Study*. Institute for Learning Innovation: Edgewater, MD. [technical report]