

Running head: A YOUTH-DIRECTED SCIENCE CAFÉ: IMPACTS ON TEEN
PARTICIPANTS

A Youth-Directed Science Café: Impacts on Teen Participants

Susan Foutz, Institute for Learning Innovation

Michelle Hall, Science Education Solutions, Inc.

Jessica J. Luke, Institute for Learning Innovation

Michael Mayhew, Science Education Solutions, Inc.

Author Note:

This research was supported by National Science Foundation Grant ISE- 0714762 awarded to
Michelle K Hall.

Correspondence concerning this article should be addressed to Susan Foutz, Institute for
Learning Innovation, foutz@ilinet.org

A YOUTH-DIRECTED SCIENCE CAFÉ: IMPACTS ON TEEN PARTICIPANTS

Abstract

Science Cafes are a popular venue for engaging adults in dialogue on issues at the nexus of science and society. A few Café programs have been designed specifically for teens. One such program, with a focus on youth leadership and promoting life skills in youth, Cafe Scientifique New Mexico, was the subject of a summative evaluation in the Spring 2010. The summative evaluation used a quasi-experimental design with matched control-treatment groups (N=383) to study the impact of the program on 1) attitudes towards science, scientists, and science careers and 2) Positive Youth Development (PYD). The PYD field (e.g. Lerner et al, 2005) posits that supportive environments help youth gain social skills, build confidence, and contribute to their community. The evaluation data demonstrated the program positively impacted participants' science-related attitudes; however, the degree to which the program's PYD outcomes were achieved is less conclusive. This analysis suggests PYD may be a difficult set of outcomes to achieve and to measure given the complexity of youth's lives and influences.

Keywords: youth, positive youth development, science communication

A Youth-Directed Science Café: Impacts on Teen Participants

Anyone working with high school age youth knows their passion for making a difference in the world and their strong opinions about how the world should work. It is this youthful conviction to make a better world and a positive outlook on the future that provides all generations with hope (Ono, 2003; Tonn & MacGregor, 2009). Yet, too often youth's opinions have a weak foundation in facts and evidence, especially when it comes to science and technology affecting their lives (Pallant, 1995). Youth are not alone in this; there is growing evidence that few people seek information contrary to their personal perspective in forming their opinions and making decisions (Pallant, 1996). This has the effect of stifling a person's ability to develop alternative hypotheses and original solutions (Tierney, 2011). Curiosity and pursuing alternate hypotheses are at the heart of scientific thinking and problem solving.

For most youth, access to scientists and exposure to scientific thinking are rare. The typical school science class often lacks the elements of scientific inquiry that make science exciting and that can open a student's eyes to scientific careers. Through the Café Scientifique New Mexico program (cafenm.org), we are providing a means to engage youth in science and technology issues and discoveries to help them better formulate their opinions about how the world works and the opportunities science and technology present for the future. We figured that because most youth are still making their plans for the future, our efforts might help them make a difference in this world through science and technology careers. The trouble with this thinking is that youth are an exceedingly hard demographic to reach due to both time and interest constraints. Many youth have full schedules with after school sports, jobs, family responsibilities and homework. And, while owning the latest scientific or technological device is very trendy and

cool among youth, knowing how to design or build one is of interest to only a few. So we wondered whether we could create a program to increase that interest in science and technology.

Before committing to develop this program we had to answer many questions including:

- How do we make science engaging and accessible to more youth?
- How do we help them see science and technology research and discoveries as relevant to their daily lives?
- How can we develop a positive culture around thinking scientifically and pursuing science, technology, engineering, and math (STEM) careers?
- How can we effectively prepare science and technology professionals to engage youth in their research and discoveries through discussion and other activities?
- If we build it, will they come?

We have two goals for the program. We want to develop a community in which youth have a strong sense of belonging and ownership, one that supports them in confidently communicating factually supported positions on science issues. We also want youth to have an increased appreciation for the relevance of science and technology in their lives and increased interest in STEM careers. The attached summative evaluation report (Foutz & Luke, 2010) indicates that we were mostly successful in achieving these goals. The purpose of this preface to the summative evaluation report is to provide a framework for understanding how we developed and implemented the program to achieve these goals.

The General Concept of a Café Scientifique Program

Our youth-directed program was inspired by the popularity of the adult Café Scientifique program that was started in Leeds, United Kingdom, in 1998 (Dallas, 2006). The UK program was based on an earlier Café Philosophique program in France, and takes inspiration from the intellectually stimulating “café society” of Paris in the 1920s and 30s. Café Scientifique programs have proliferated in recent years to more than 30 countries with more than 71 in the United States and Canada alone (www.Caféscientifique.org). Such programs—in which citizens engage in dialog with a scientist to learn about some hot science topic in the news—are held in pubs, restaurants, or coffee shops, but may also take place in other social settings, such as museums and science centers.

Although the details of individual Café programs may differ somewhat (Dallas, 2006; Adams, 2004; Giles, 2004; Cohen & Macfarlane, 2007) all combine two essential ingredients. First, they take place in a collegial social setting—usually involving food and drink—that encourages participants to interact with each other. Second, they build upon participants’ existing knowledge and satisfy their curiosity about a science-based topic through lively interaction with a scientist. It is this blend of the two ingredients that accounts for the Café model’s growing popularity.

After learning about the popularity of the adult Café Scientifique model, we wondered if such a format could be used to engage youth in exploring science and technology in their lives. Could this kind of social interaction with a scientist get youth to see scientists as interesting people with great passion and excitement for their work? A proposal to the US National Science Foundation

to explore these ideas was funded, and in 2007, the staff of Science Education Solutions started up a novel Café Scientifique program for youth in four towns in northern New Mexico.

Adaptation of the Café Model for a Youth Audience

Focus group discussions with high school age youth guided our initial design for the Café format. However, we have continually made adaptations to the program as the youth and we learn more about what is and is not increasing youth engagement and learning. Our work is informed by formative evaluation conducted by the Institute for Learning Innovation (Foutz, 2008; Foutz, 2009; Lelliott & Foutz, 2009), comment cards from Café participants, post-Café feedback from speakers on their experience, and feedback from youth leaders in the program.

We host two Cafés monthly during the school year in each of four New Mexico towns—Española, Los Alamos, Santa Fe, and Albuquerque. Each month focuses on a particular theme such as genetically modified foods, brain synapse functions and malfunctions, nuclear weapons and nuclear power, crime scene investigations, and the future for alternate fuel vehicles. We expected that this would give youth more insight into cutting edge science unfamiliar to them and would help them to make connections between Café presentations, and it has. Youth often make reference to Café presentations in which the speaker unknowingly presented overlapping content from a previous Cafe that reinforces big ideas.

Program Format

The format of the Café program has evolved with the benefit of experience and the feedback we have received from the youth participants. The primary adaptation we made is to the typical the

Café format. A typical Café program for adults begins with a 20-minute presentation, followed by a 10-minute intermission to refresh drinks and talk with a friend about the presentation ideas, and then an hour or more of open discussion. Our initial plan was to have a Café of this traditional format early in the month, followed two weeks later by a Café on a related topic that primarily offers active inquiry.

For the more traditional Café format, we encouraged the presenter to pose a relevant controversial question or conundrum to stimulate a spirited discussion or debate among the youth, but not all topics lend themselves to this. We used both small and large group discussion techniques, with the scientist moving from group to group to engage in these discussions. We began providing sample discussion questions to facilitate discussion. With the right topic and a highly dynamic speaker this format can work for youth, but it is not their preferred format. And, in general, it did not achieve the kind of vibrant and wide-ranging discussion we had hoped might occur among the youth. It felt a bit school-like at times.

However, the second Café each month was generally a big success. Hands-on activities fostered greater interaction, enthusiasm, and positive feedback. Feedback in comment cards and formative evaluation indicated that the youth preferred hands-on learning, yet the top rated aspect of the Café in the formative evaluation was interacting with the scientist and learning about the scientists' own research. So, we had a bit of a dilemma about how to make each Café fully engaging. Also, we struggled to find hands on activities that were simple and low cost enough to provide for drop-in audiences of 30-130 youth and to keep the program focus on

informal learning. Over the first year, we ultimately evolved to a format in which each Café has some time for a presentation and discussion and some time for active learning.

Today our Cafés may take the form of highly interactive hour-long presentations peppered throughout with questions to and from the audience or a 10-30 minute presentation followed by game play, computer challenges, experiments and more. Youth have learned how to decipher remote sensed images that use Google Earth imagery to “spy”, had a dialog with a person who has lived 19 years with the HIV virus, explored nanotechnology through experiments and games, learned how to determine gender, age, race, and cause of death from a skeleton, matched crime victims to specific crimes using three complete human skeletons and an unsolved crime catalog, and built model fuel cell cars. We have even convened Saturday field trips to a television station, bronze foundry, and the National Weather Service.

What we have learned from participants’ written comment cards and the youth leaders’ oral feedback is that, like the adult Cafés, the less formal and more interactive the presentation, the better the experience. We have also observed that programs that are mindful of, and build on, the prior knowledge and interests of the youth have richer discussions and questions (Dallas, 2006). Technical language is not important to stimulating interest and learning; in fact, it can easily quash learning. Focusing on teaching a single big idea or a single big concept is more effective than covering many big and small concepts. The youth really appreciate balanced presentations that address both sides of a controversy or present both the positive and negative implications of new discoveries. Because their knowledge is more limited, youth do not feel comfortable debating the expert, so the expert must come prepared to talk about what is and is not known on

the subject and alternative hypotheses to their own preferred hypothesis. Presentations that project only gloom and doom for the future can be discussion killers. Youth do not want to hear about topics with the underlying message that humans have wrecked the Earth and we are all doomed. If presented with a topic dwelling on a looming problem, they want to hear about possible solutions and new directions for research.

Essential Ingredients of a Successful Teen Café Program

We have learned that all of the ingredients described below are necessary for a teen Café to work well; none by itself is sufficient. This means that organizing such a program is not a trivial venture. On the other hand, interacting with the youth and the scientists, experiencing the excitement and enthusiasm of both, and perceiving an evolution in the youths' perceptions of science and scientists provides some very significant rewards.

Youth Ownership of the Program

While youth feedback in the formal evaluation of the Café program indicates that having a dedicated program director, dynamic scientists as presenters, and engaging topics are most important for a successful Café program (Foutz & Luke, 2010), the program directors have an additional perspective. We believe that having youth leadership is extremely important to keep abreast of the needs and interests of the target audience month-to-month and to keep the program fresh and vibrant. To the greatest extent possible, we have allowed the youth to embrace the Café program as *their* program. An important aspect of this is the Youth Leadership Teams (YLT) formed in each town.

The youth leaders run all aspects of the Café meetings (with adults in the background providing support as needed), advise on what topics should be presented, and assist with promoting the program in their respective communities. They enthusiastically recommend menus for the food provided at the meetings. They help prepare the speakers by providing frank feedback during their dry run presentation. In contrast to their typical experience in school or at home, we give them every opportunity to run the show and take charge. We have found that this is a pivotal aspect of the program, which sustains the youth leaders' ongoing enthusiasm for and commitment to it.

Any high school teen that wishes to can join their town's Youth Leadership Team. Each season, we bring the YLT volunteers to a spirited meeting shortly before school starts, where they do some bonding and learn (or are reminded), and volunteer for different responsibilities as youth leaders. These may include orchestrating elements of the meetings or advertising and recruiting of youth participants. We also discuss topics for the upcoming Café season. We have found that this meeting sets the tone for the rest of the season because the youth leaders understand what is going to happen in the coming year and what their responsibilities are.

Each month during the academic year, the adult leader in each town meets with the YLT to plan the next month of Café meetings and in general keeps in touch with youth leaders to better assess how the program is going and what changes might need to be made. At the end of each Café program, youth leaders are asked for their candid feedback on the program overall. A sense of camaraderie and shared purpose typically emerges within each town's YLT. In our evaluations,

the youth leaders have told us that they appreciate having the opportunity to take on responsibilities and learn leadership skills (Lelliott & Foutz, 2009).

Summative evaluation data indicates that most youth participants other than the youth leaders feel a sense of belonging at the Café meetings, but generally do not have a feeling of ownership of the program (Foutz & Luke, 2010). This is not unexpected, as most youth simply participate in a planned activity twice a month. However, our youth leaders have shown great pride and expressed a strong sense of ownership through their words and actions to continually help to improve the program. As one youth leader told us, *“Adults often tell us it is our program, but you actually let us make the decisions and run the program.”*

Roles of the Youth Leaders During the Café Program

A group of youth leaders arrives a half hour early, and some of them begin to set up the food table. Another group sets up a greeting table, and mans it until the presentation starts. They greet people as they arrive and get them to fill out a card with their names and contact information. The benefit for the program is that this allows us to develop a contact list that we can use to remind youth about upcoming meetings. We also use the sign-up cards for door prize drawing at the end of the meeting. Those who have brought friends in a car pool fill out a special form; we provide a small stipend to them to defray the cost of gas. Carpooling also helps some youth that might not be able to attend otherwise.

All youth participants gather for an initial period of socializing with food and drink. Substantial refreshments are provided, as many youth are coming from a sports practice or after school job

and have not had dinner. The presentation or program begins at about 10 minutes after the start time for the event. Then the food table is closed for the duration of the presentation, and a member of the YLT introduces the speaker, giving a brief overview of his or her background. (Some youth enjoy doing this stand-up routine, and value the opportunity to improve their presence before an audience.) At the end of the presentation, a YLT member thanks the speaker and makes some closing announcements, including the topic of the next Café. The presenter ceremoniously conducts the drawing for the door prize. Finally, the YLT clean-up crew gets to work.

Venues

The venue for the Café is very important. It must be conducive to social interaction and small and large group discussion. It must encourage movement among groups and allow for hands on activities. Moveable tables and chairs are optimal. Theater style or other fixed seating that inhibits people from clustering in groups or being able to easily talk with people around them will inhibit discussion. Additionally, poor acoustics or lack of a proper audio-visual system in a large meeting can invite unrest and side conversations.

Recruiting and Preparing the Presenters

The process for entraining a scientist-presenter in the program begins with the YLT; youth leaders are eager to tell us what topics they think would be interesting in a Café. Now, the youth do not know the universe of interesting science, and we may not be able to find a scientist who is available to present on a particular topic they suggest. Further, a great presenter can make an obscure topic come alive, while a poor presenter can make the most interesting topic seem

boring. Nevertheless, we make every attempt to satisfy the youths' wishes. So, for example, Cafés on cyber-warfare, the origin of humans, asteroid impacts, and spying resulted from youth recommendations.

The next step in finding good presenters is to simply ask around. We are fortunate to have Los Alamos National Laboratory, a major university, and several smaller colleges in our area to draw from as well as scientists in several Federal and State government agencies. We approach contacts in these organizations and elsewhere and ask for recommendations on colleagues who are doing some particularly interesting research and have given public talks on the subject. The public relations office in these organizations can be of great help, as they typically have had to work with scientists in their organization to promote their work to broader audiences. These offices can be good sources of information about the communication skills of the scientists. We make further inquiries about likely presenters that have been recommended to us. We learned from one bad experience that it is important to thoroughly vet potential presenters. They need to have a good science story to tell, have some facility with speaking to a public audience, and—importantly—are able to grasp the challenge of successfully interacting with our particular audience.

We approach likely presenters and explore their interest in participating in a Café; with few exceptions, we have found the scientists we have approached to be eager to participate. We establish a tentative Café date for them. We provide them with written guidelines and suggestions intended to frame their preparation for the Café session. The guidelines stress the importance of knowing the audience. These are youth who will readily engage with a presenter

on some hot science topics, if it is accessible to them. It is best to assume they know nothing at all about the topic. The presentation needs to be free of jargon and delivered in an engaging manner at a basic level so that youth will be pulled in and have a chance to develop some new mental images.

It is important that presenters not try to cover the whole breadth of a science topic, thus creating too many new mental pictures for the youth to try to process at once. A better approach is to organize the presentation around one essential provocative idea or concept, and let everything flow to it. This we refer to as the *Most Important Thing*. It is most desirable that the *Most Important Thing* be deliberately designed to include unanswered questions, a dilemma, or controversy that is accessible enough to the youth that they can engage in discussion of it. And it is most effective if a presenter leads up to the *Most Important Thing* by *telling a story*. In our first year of the program we actually engaged a professional storyteller in a workshop to work with presenters, which was quite effective.

It is a challenge to get the scientists to give presentations appropriate for the youth and the informal setting, as opposed to what they are used to: presentations to peers. But typically, after some initial trepidation, they rise to the occasion. The first step is iteratively developing the presentation. Typically, as program leaders, we can help the presenter simplify the language and complexity of the content, from removing jargon and excess information from slides to ensuring diagrams and charts are easily interpreted. We coach the presenters to seek out interaction with the youth audience throughout the Café session by asking questions and posing challenges, using

props and demonstrations. This has the added benefit of allowing the presenter to gauge whether and what the youth understand.

We have found that it is highly valuable for presenters to do a dry run with a small group before presenting to a full house of youth. Initially, we did dry runs with an audience of peers. This was generally eye-opening to the presenter to learn that scientists from other fields could not effectively sift through the jargon any better than the public. Later, the youth leaders suggested that dry runs be done before a group of youth after school; this has proved exceedingly valuable in getting the presentations pitched at the right level. However, it also takes a bit of coaching of the youth to get them to constructively critique the presentation. Interestingly, because the time and effort for creating this presentation is higher than the speaker may put into other professional presentations, several have commented that giving the presentation multiple times makes the investment worth it.

The result is that the speakers have a better sense of what youth know and how they will respond to the presentation. Several speakers who doubted the importance of the dry run presentation to the youth later told us that it had been a watershed experience. They had not realized how little they knew about youth background knowledge or level of critical analysis, and the wide variety of these skills. For others, the experience relieved them of their fear of this unknown audience.

We also ask the presenters to write two 1-page essays, one a summary of the science topic as they will present it, the other a 1-page biographic sketch. This is a key step to helping the presenter begin thinking about the needs and interests of the youth audience. We work with them

on the essays by providing constructive feedback and editing. The essays are posted on the Café Web site in advance of the Café session in order to stimulate good questions and substantive interaction during the session. The essays are most effective if both take the form of a *story*, as with the presentation itself.

In the biographic sketch, the presenter tells his or her own personal story. We stay away from the usual formal—and typically rather sterile—professional biographic sketch. It is much more engaging to the youth if a picture of the real person emerges—where did they come from, how did they get to where they are, what has grabbed their interest along the way, what has pulled them in and what leaves them cold, what their lives are like in their present research position. We want to get across that a scientist is a real, complex, multidimensional human, with his or her own unique set of motivations, delights, abilities, and foibles. The formative and summative evaluation suggests this seems to be working as the youth find the speakers to be interesting and one of the best elements of the program. They enjoy learning about the scientists and their careers.

We encourage presenters to get across that—in part because of a career in science—he or she has had, and is having, a particularly interesting life. Scientists are not particularly used to thinking in terms of their personal stories—but each has had an interesting and unique story to tell. Telling that story is an important hook for pulling the youth into the science story. The essays have developed into a very interesting collection on the Café Web site at <http://cafénm.org/schedule.html>. We distribute them at the Café program; however, we have difficulty getting the youth to read them prior to the program.

A serendipitous aspect of the Café Scientifique program is that a cadre of scientist-presenters who have come to self-identify with this informal science education program and who have been trained to share the fruits of their science with the public has grown large.

Recruitment and Retention of Youth Participants

Schools are critical to our recruitment. The school day and after school activities dominate the schedule and routine of youth lives. Within school, they are reminded many times of upcoming events. We advertise the program through flyers posted at the schools, daily announcements, emails to teachers and youth participants, postings on school marquee signs, and by posting to the Parent Teacher organization listservs. We also collect email addresses of any parent who comes to the program and send them regular messages about the program activities.

Teachers are important as outlets of information about the program. Some offer extra credit which helps get youth to the program at least once. But, we have also found that when extra credit is the only reason to come, many only come once. Extra credit does not matter as much, if at all, to the youth interested in the program and science. Regular attendees often do not sign in for our door prize, which provides us the information on who attended and who might get extra credit.

We also announce the program meetings on our Cafénm.org website, our Café Scientifique NM Facebook page, public and community radio stations, in the community calendar of the local

newspapers, and even on the community websites of the local television stations. All of our advertising is free.

As we serve smaller towns and a mid-sized city, we have also been able to get stories published in local newspapers on a number of our Café programs. We encourage the employers of our speakers to highlight the event on their website. In the case of Los Alamos National Laboratory, where more than 60% of our speakers are employed, they have written stories about the program for their daily and weekly news that is distributed to all employees. This is an important audience, as this reaches a significant number of parents of the teen audience we are serving in three of our towns, Los Alamos, Española, and Santa Fe. These articles also raise the profile of the program and our speakers, making it easier to recruit future speakers.

Numerous opportunities have shown that regularity in all aspects of the Café program results in higher attendance. Weekend field trips have proven popular in theory, but in practice, youth cannot remember the details of where/when without personal reminders or their schedules do not have the flexibility to participate. We email all youth about the program twice each month and have over 400 of the 1400 students participating each year as friends on our Facebook site. Text messaging and cell phone are effective means of communicating with the Youth Leaders, in particular, as it is more immediate when there are changes in our program plans.

Retention is achieved through these regular and frequent communications; however, it is the experience at the Café that makes youth come back again. We make it fun with food, socializing, and active learning, treat them as young adults, and focus on topics that appeal to the youth. Our

carpooling incentives provide money to youth drivers to offset the cost of gas if they bring one or more of their friends or siblings, thereby, increasing the likelihood of a positive experience and return visit. Youth leadership retention is very high, due to a sense of community they develop. And, the youth leaders themselves extend that sense of community to their friends and peers, making the Café a welcoming place for all.

Retention is also increased by paying attention to the school calendar and avoiding conflicts with major school activities and cycles. We run the program in seven months of the school year. There are meetings in September through November, followed by a break for the holidays. We pick up in January and go through early April. We found that by mid-April College Board tests, AP tests, and State performance tests begin to consume the youth's academic lives, and by May students are too busy with end-of-year schoolwork. Hosting a Café at these times was not sensible.

For youth leaders and general participants, we also do not require or pressure them to attend each Café. Many are athletes and cannot attend during the season of their sport. Others have concerts, plays, debates, and other activities that may conflict. We make a point not to pressure the youth to commit to our program over another. As a result, we have youth leaders who stay involved in the planning meetings throughout the year and attend dry run presentations, even if they cannot attend the regular Café meetings. We feel this increases our overall retention of youth and strengthens the program by encouraging long-term commitments, even if they are sporadic.

Role of Parents

At most meetings, there is a cadre of adults in the audience. They are often there because they drove their child to the meeting. In most cases they seem genuinely engaged. We welcome the parents, but ask them not to speak during the discussion and to leave any questions that they have for the speaker until the youth program is over. In all cases, parents in the audience have been a benefit to the program. We have not had any parents take a direct role in the meetings, though many will speak to the presenter or the adult leaders about their experience at the end. The feedback we get from parents is that they are very appreciative that their child gets such an experience. Parental support is also very important for our youth leaders. Parents recognize the value in the time commitment to the Café program and encourage it openly. When calling homes to remind the youth leader of a meeting or commitment, the parents are very helpful. We have a number of parents on our email list because they want to be informed.

Impacts of the Café Scientifique Program

We started this project with some trepidation: what if we build it and they don't come? But the program actually has proven popular far beyond our expectations. Attendance has continued to grow. Over 50% of the youth return for multiple Café events each year, a high retention rate for a drop-in program. The impacts on youth are visible in their enthusiasm for the program and commitment to keep it running. Youth have said in our formative evaluations and in comment cards collected at the end of a Café session that they: increasingly see science everywhere in their lives and better understand its importance; can put the science they learn in school within a more relevant context; discovered that scientists are interesting people leading enjoyable lives in science; and have gained interest and knowledge in STEM and STEM careers (Foutz, 2009). For

more data on the impact the program has had on youth, please see the attached summative evaluation report.

Impact on scientists

Feedback from scientists has been uniformly positive and encouraging. Many scientists have heard of the program and have positive views of it when we first approach them about speaking. About two months before their presentation, the reality of writing a biographic sketch and essay and doing a dry run and four presentations around the state sets in. As the deadline looms, we do a lot of hand holding, pleading, and cajoling to have them put the Café at the top of their very full to-do list. So far, all have come through brilliantly, and on time.

Most get very excited at the reaction of the teens and the fact some 30-100 kids turned out to discuss science with them. They tell us that they have learned a great deal about talking to the public and really enjoyed giving this type of presentation. They want to help us find future speakers. Two of our speakers have put the link to their biographic sketch and presentation in their Christmas letter to family and friends and others link to it from their websites or online resumes. Below are notes from some of our speakers that capture their pleasure in participating in the program. Despite the somewhat grueling schedule of four presentations over a two-week period in towns separated by 100 miles, we are regularly thanked for the opportunity we gave them.

I would like to say to you, M and the wonderful woman at the Santa Fe complex (forgot her lovely name), how much I enjoyed the whole experience! It was inspirational to interact with your team and the students. You provide a great

service to New Mexico through the Café. I am excited about continuing to work with you in the future. Thanks for inviting me to participate. Your team is just amazing! — C.W.

*Thank you for the opportunity to participate in the Café Scientifique. It was a pleasure to see so many young students interested in science and excited about learning. They are welcome to come visit the Ag Experiment Station anytime.
— C. M.*

I strongly support your program. I honestly can't think of any program I experienced as a youth that was like yours. Having such an opportunity to hear from technical professionals would have helped me find the right career much earlier than I did. Programs like yours are invaluable.... Thank you for all that you do to help our future scientists and engineers plan their careers. — L. D.

The attached summative evaluation of our program provides detailed information on the impacts we have had on our target audience of youth, as well as feedback from speakers.

References

- Cohen, J., & Macfarlane, H. (2007). Beer and Bosons at the Café Scientifique. *Museums & Social Issues*, 2 (3), 233-242.
- Foutz, S. (2008). *A Youth-directed Café Scientifique: Formative Evaluation Year 1, Online Formative Survey*. Unpublished technical report. Edgewater, MD: Institute for Learning Innovation.
- Foutz, S. (2009). *A Youth-directed Café Scientifique: Formative Evaluation Year 2, Focus Group Impact Study*. Unpublished technical report. Edgewater, MD: Institute for Learning Innovation.
- Foutz, S., & Luke, J.J. (2010). *A Youth-Directed Café Scientifique: Summative Evaluation*. Unpublished technical report. Edgewater, MD: Institute for Learning Innovation.
- Giles, J. (2004). Pop science pulls in public as café culture goes global. *Nature*, 429 (27 May 2004), 333.
- Lelliott, T., & Foutz, S. (2009). *A Youth-directed Café Scientifique: Formative Evaluation Year 2, Online Formative Survey*. Unpublished technical report. Edgewater, MD: Institute for Learning Innovation.
- Ono, R. (2003). Learning from young people's image of the future: a case study in Taiwan and the US. *Futures*, 35, 737-758.
- Pallant, E. (1995). Teaching critical thinking using controversial issues. *The Teaching Professor*, 9 (10), 6-7.
- Pallant, E. (1996). Assessment and evaluation of environmental problems: teaching students to think for themselves. *Journal College Science Teaching*, 26, 167-171.
- Tierney, J. (2011). Social Scientist Sees Bias Within, *New York Times*,

www.nytimes.com/2011/02/08/science/08tier.html

Tonn, B. &MacGregor, D. 2009. Individual approaches to futures thinking and decision making.

Futures, 41, 117-125.

A Youth-Directed Café Scientifique: Summative Evaluation¹

Introduction

The Institute for Learning Innovation (ILI), an Edgewater, MD-based non-profit research and evaluation organization, conducted the summative evaluation of the Youth-directed Café Scientifique project developed by Science Education Solutions, Inc (SES). The summative evaluation took place in Year 3 of the Café program, which corresponded to the academic year 2009-2010. Building on formative evaluation work from the program's first and second years (2007-2008 and 2008-2009), the summative evaluation was designed to provide SES staff with an understanding of the outcomes for the program's youth participants and information on the program model.

Program Description and Goals

A National Science Foundation grant in the area of Informal Science Education was awarded to SES in 2007 to establish a youth-focused Café scientifique (NSF-DRL-ISE grant # 0714762). Programmatic offerings have varied over the length of the project. Initially, two types of events were designed: 1) a Café scientifique is held where a scientist or other expert introduces a topic and then group discussion on the topic and 2) a follow-up activity related to the topic of the Café. Over time the program has come to use a more interactive format for all events, though two meetings per month on the same topic are typical. The formats for the events can vary and may include:

¹ The summative evaluation was conducted by Susan Foutz and Jessica J. Luke, Institute for Learning Innovation.

- A fully interactive talk in which the presenter is continually questioning the audience and answering their questions.
- A 30 minute presentation followed and 20-30 minutes of hands-on learning, which allows for exploration of materials, artifacts, or techniques related to the presentation.
- A traditional science café format using presentation followed by group discussion, although has become rarer with the introduction of interactive sessions.

The project's target audience is high school-aged youth in four locations in New Mexico (Santa Fe, Albuquerque, Los Alamos, and Española/Pojoaque). Youth recruited at each location help to establish the program topics, vet the presenters, and plan the activities under the guidance of SES staff. These youth are members of the Youth Leadership Team (YLT) at each site, and form the core of the program. Each month, both a Café and follow-up activity occur at all four sites. The Café at each site features the same topic and presenter. Follow-up activities focus on the same topic as the Café, but the format and specifics are influenced by the YLT at each site, and therefore may vary from site to site. The first Cafés were held in January 2008 and have continued during the academic year throughout the three years of the grant.

Through participation in the program, youth will²:

- Develop a community in which they have a strong sense of belonging and ownership that supports them in confidently communicating factually supported positions on science issues;
- Have an increased appreciation for the relevancy of science and technology in their lives and increased interest in STEM careers.

² The project goals referenced are those from the NSF proposal for "A Youth-directed Café Scientifique."

The project also aims to impact the field of informal science education through:

- Providing knowledge on how the Café scientifique model of social engagement in science works for youth generally and within specific cultural or socio-economic groups more specifically.

Evaluation Purpose and Questions

The summative evaluation for this project had two foci: 1) outcome evaluation of youth participation in the Café Scientifique Program and 2) an assessment of the Program model for future replication. Summative evaluation by its nature is designed to assess the effectiveness of the program in reaching its intended goals or outcomes. In this case, the two evaluation foci and questions related to each served to guide the evaluation.

Impact evaluation of youth participation in the Café Scientifique program

The impact evaluation drew on a framework described in the field of Positive Youth Development (PYD). The PYD field has evolved out of a desire to approach children and youth as individuals with positive assets to be developed. Prevention-based programs originally focused on changing negative behaviors or outcomes, such as drug abuse or teen pregnancy (Catalano et al, 2002). By the 1990's, a new approach developed that focused more broadly on the suite of issues that face youth as they transition to adulthood, with the view that a successful transition meant more than avoiding risky behaviors (Catalano et al, 2002). The PYD approach does not replace prevention-based programs but does offer a framework for creating and evaluating programs with a distinctly positive focus (Eccles & Gootman, 2004). As an asset-

based approach, PYD focuses on the child as a whole person within a network of influences in an effort to support healthy, successful youth development. There are multiple strategies to describing and evaluating PYD-focused programs, including outcomes-based and structurally-based frameworks. A structural framework is described by McLaughlin (2000), with the idea that a successful PYD program has certain program foci (youth-centered, knowledge-centered, assessment-centered, community-centered) not necessarily fixed outcomes. An example of an outcomes-based framework is described by Lerner et al. (2005), where six outcomes, called the “six C’s” (competence, confidence, connection, character, caring and compassion, and contribution), are the basis for a successful program.

The summative program evaluation used the six C’s framework of Lerner et al (2005) to ground the inquiry into PYD impacts on program participants. Non-PYD-related participant impacts, such as attitudes towards science, were also important to the program model, and therefore were also investigated. This learner-centered approach to evaluating a science Café was supported by the work of Lehr et al. (2007); one of three frameworks for evaluating dialogue events (of which a Café is one type) described by the authors is that of “symmetrical individual learning through social processes.” This framework is in contrast to frameworks that focus on social justice outcomes, policy impacts, or collaboration and equity.

The following questions guided the impact evaluation; the “C” represented is in parentheses:

1. Does engagement in the program group enhance youth participants?:
 - a. Understanding of current STEM content and issues? (competence-cognitive)

- b. Sense of confidence and competence in their ability to develop and communicate factually supported positions on STEM issues? (confidence and competence-cognitive)
 - c. Appreciation for and interest in STEM careers?
 - d. Attitudes toward science, the process of science, and scientists?
 - e. Personal development, such as growth in character, perceived contribution to their community, and leadership skills? (character, caring and compassion, contribution, competence-social)
2. To what degree do youth feel a sense of belonging to and ownership of the Café community? (connection, contribution)

The Program Model

The summative evaluation also included an assessment of the program model to inform for future replication. Developed with the program staff, the following questions served to guide the study of the program model:

1. Which components of this project are most vital to its success? Which are optional?
2. What are key factors to ensure successful implementation of this model?
3. What do the partner organization staff, project staff, science experts, and youth see as the greatest benefit and challenge of participation in the project?
4. Which characteristics (content, format, product) of the program offerings draw the largest community support?
5. Are there differences in how the program operated and was perceived by participants and

staff at each of the four sites? If so, what are the differences between sites? What implications might between-site differences have for the model?

6. What role do members of the YLT play in the participant experience and within the model?

For the purposes of reporting the data, the findings related to the Café Scientifique model were organized into the following three sections:

1. Elements of the program model, including the groups involved, topics selection, and speaker preparation, and the Cafés themselves.
2. Site differences and the role of multiple sites in the model.
3. The net value of the program.

Methods

The summative evaluation employed a quasi-experimental, post-only treatment/control design to investigate program outcomes for participants, and a descriptive design to assess the program model. Primary methods included written quantitative surveys with youth participants (and a control group) and focus groups with program staff, scientist presenters, and youth participants from the YLT. This strategy allowed for an in-depth understanding of how the program model works and what impacts it has for participants.

Written Surveys

Written quantitative surveys were used to investigate the program outcomes for youth

participants. A quasi-experimental design was used, allowing for a matched (non-randomly selected) control sample. The design allowed for two types of comparisons: 1) between youth who participated in the Café program (treatment group) and youth who did not (control group), and 2) retrospective pre-program participation and post-program participation for youth who participated in the program. Program participants and non-participants rated their interest, attitudes, and knowledge towards science, STEM careers, and measures of PYD. Program participants rated these items twice for both before their program participation and after program participation. Program participants also rated their sense of belonging to and ownership of the Café program. Therefore, there were two versions of the survey, one for program participants and one for non-participants. Independent variables included: location of program attendance (town), program participation (e.g. length, intensity, whether the teen was a youth leader in the program), year in high school, number of high school science courses taken, participation in other science-related programs (e.g. MESA and the STEM program), measures serving as proxies for socio-economic status and family values for education (e.g. number of adults in their household who are employed, number of adults in their household who attended college, parental expectations for the teen to attend college, and whether there was a scientist in their family). See Appendix 1 for the survey instruments.

Data were collected in April 2010 at Café-related events and at selected high schools in each town that Café participants attended. Data from the treatment group were collected at the Cafés and at the high schools; data from the control group were collected only at the high schools. Program staff at three of the four towns collected data during their April Café program (all except Española/Pojoaque). There was no incentive given at the Cafés for completing the survey,

although the Café events always include food and door prizes for participants. Survey data from participants were collected from Española/Pojoaque and Los Alamos participants during focus groups that were part of the summative evaluation.

Table 1: Survey sample by data collection location

Location of Data Collection	Sample Size		Percent of Overall Sample
	Participants	Non-Participants	
Albuquerque	25	94	31% (n=119)
Café Event	17	N/A	
Eldorado High School	8	55	
Albuquerque High School	0	39	
Española/Pojoaque	48	58	28% (n=106)
Café Event	6	N/A	
Pojoaque Valley High School	26	29	
Española Valley High School	16	29	
Los Alamos	72	19	24% (n=91)
Café Event	57	N/A	
Los Alamos High School	15	19	
Santa Fe	40	27	17% (n=67)
Café Event	22	N/A	
Santa Fe High School	18	27	
TOTAL	185	198	100% (n=383)

High schools in each town were selected for data collection on the basis of the proportion of Café participants who attended each school. For example, if a town drew its Café participants from three high schools, the two high schools which drew more participants were selected for data collection. See Table 1 for the list of schools selected and the sample from each. For data collection at the high schools, permission from the administration was obtained to: 1) be on the school grounds, 2) distribute the survey during a lunch period, and 3) give an incentive (e.g. a slice of pizza, a sandwich, candy, ice cream) to those who completed the survey. On the day of data collection, one program staff member and one member of the evaluation team visited the school during the lunch hour. At a table in the school's lobby, the data collectors distributed surveys and pencils to teens, determining if they had or had not participated in the Café program

to ensure the teen would complete the appropriate survey. When a teen completed their survey, they were given an incentive. Data collection concluded when all the incentives had been given out or the lunch period was over. Members of the Youth Leadership Team (YLT) who attended each high school assisted with logistics, such as setting up the table, handing out pencils, and distributing incentives.

Survey data was entered into Excel and converted into an SPSS file for analysis. Appropriate statistical analyses were performed, including non-parametric tests for statistical significance between sub-samples.

Focus Groups

Focus groups were conducted to better understand the program model. At each town in which the Café program was held, members of the YLT were invited to gather to reflect on the program as a whole and their site specifically (n=4, one at each site). Topics of discussion included the role of various people in the Café model, the benefits and challenges of attending the Café, and essential components to the Café model. These focus groups were held in April 2010 at the location where the Café events were typically held. They were conducted by members of the ILI staff. The focus groups were audio recorded; participants who were younger than 18 years old were required to bring a permission slip signed by their parents for them to participate in the focus group and be audio recorded. All participants were told of the audio recording in advance. Consent (from 18 or older) and assent (from those under 18) was obtained before audio

recording began. Food was provided. Table 2 provides an overview of the focus group attendance. See Appendix 1 for the focus group instrument.

In addition to the focus groups with youth, a focus group was held with scientists who spoke at a Café, current site coordinators, and the project director. Another focus group with two participating scientists was also held. These focus groups were conducted in April 2010 by ILI staff members. The focus groups were designed to allow for group synthesis and reflection on the model. Topics of discussion included the role of various people in the Café model, the benefits and challenges of attending the Café, and essential components to the Café model. The focus groups with the program staff and scientist-speakers were also audio recorded and consent was obtained before recording began. See Appendix 1 for the focus group instrument.

Table 2: Attendees to the focus groups

Focus Groups	Number of Attendees
With Teens	
Albuquerque YLT	6
Española/Pojoaque YLT	8
Los Alamos YLT	8
Santa Fe YLT	2
With Adults	
Scientists and Program Staff	11
Scientists only	2

The audio recordings of all six focus groups were sent to an independent company (Verbal Ink) for transcription. The transcripts formed the basis of the focus group analysis. The youth focus group transcripts were reviewed for areas of convergence and divergence among the four towns. The adult focus groups were reviewed for cross-cutting themes that spoke to the nature of the program model.

Findings

The findings for the summative evaluation of *A Youth-Directed Café Scientifique* are organized by the two evaluation foci (outcomes for participants and the program model) and reported below.

Impact evaluation of youth participation in the Café Scientifique program

Descriptions of the Sample for the Quantitative Survey

Data were collected from a total of 198 non-participants (control group) and 185 participants in the Café program (treatment group). Analysis of basic demographics and psychographics showed that the treatment and control samples were well-matched in terms of gender, number of employed adults in the household, number of adults in the household who had attended college, and parental expectations their child to attend college (See Table 3). There were no significant differences between participants and non-participants on these variables.

Table 3: General demographics and psychographics of the survey sample

Category	Percent of Sample		Significant Difference?
	Participants	Non-Participants	
Gender	(n=179)	(n=187)	
Male	54%	51%	No
Female	46%	49%	
Year in High School	(n=175)	(n=185)	
Freshman	12%	16%	No
Sophomore	24%	25%	
Junior	41%	40%	
Senior	17%	18%	
Other	6%	1%	
Number of Employed Adults in Household	(n=176)	(n=186)	
None	8%	8%	No
One	26%	23%	
Two	56%	51%	
Three or More	10%	18%	
Number of Adults in Household who Attended College	(n=176)	(n=184)	
None	17%	20%	No
One	23%	27%	
Two	50%	39%	
Three or More	10%	14%	
Do your parents expect you to go to college?	(n=172)	(n=182)	
Yes	96%	94%	No

Note. The Pearson Chi-square test was used to test for statistical significance.

Youth who participated in the Café program were different from non-participants on some of the science-related independent variables (See Table 4). Youth in the program were significantly more likely to have a scientist in their family, (38% compared to 23%; $\chi^2 (1, N = 361) = 9.11, p < .01$) and were significantly more likely to participate in a summertime STEM-based program (7% compared to 3%; $\chi^2 (1, N = 382) = 4.38, p < .05$). This indicates that youth who participate in the Café program may be self-selected; they may have higher exposure to science opportunities outside of school because of personal interest or a family culture that supports science interest. There were no differences between participants and non-participants on the

basis of number of high school science classes³ taken or participation in other science extra-curricular activities (i.e. MESA and science clubs).

Table 4: Science-related psychographics of the survey sample

Category	Percent of Sample		Significant Difference?
	Participants	Non-Participants	
Number of Science Classes taken in High School (past and current)	(n=166)	(n=184)	
1 class	14%	12%	
2 classes	19%	21%	
3 classes	36%	44%	No
4 classes	20%	17%	
5 or more classes	12%	7%	
Participation in Science-related Extra-curricular Activities	(n=184)	(n=198)	
MESA participant	9%	10%	No
STEM Program participant	7%	3%	Yes ^a
Science Club participant	15%	11%	No
Do you have a scientist in your family?	(n=175)	(n=186)	
Yes	38%	23%	Yes ^b

Note. The Pearson Chi-square test was used to test for statistical significance.

^a $\chi^2(1, N = 382) = 4.38, p < .05$

^b $\chi^2(1, N = 361) = 9.11, p < .01$

The program staff was particularly interested in any differences in the sample on the basis of the four towns where the Cafés were held. Based upon their knowledge of the area, they hypothesized that the sample from each town would vary. This hypothesis was correct for a number of variables; statistically significant differences for the whole sample (participant and non-participant) based on the four towns were found for the following independent variables:

- Number of employed adults in the household ($\chi^2(9, N = 362) = 21.029, p < .05$), with no employed adults in the household most likely in Española/Pojoaque.
- Number of adults in the household who attended college ($\chi^2(9, N = 360) = 42.044, p < .00$), with the most college attendees in Los Alamos and the least in Española.

³ Number of science classes taken was closely related to year in high school, with most freshman having taken one class, sophomores two, juniors three, and seniors four classes.

- Scientists in the family (X^2 (3, N = 361) = 75.755, $p < .00$), with more teens in Los Alamos having a scientist in the family than at the other towns.
- Number of science classes taken in high school (X^2 (12, N = 350) = 26.743, $p < .00$), with Los Alamos teens having taken more science classes on average than in the other towns.
- Participation in science-related extra-curricular activities:
 - MESA participation was highest in Española/Pojoaque (X^2 (3, N = 382) = 21.954, $p < .00$)
 - More teens participated in science clubs in the Albuquerque and Los Alamos samples (X^2 (3, N = 382) = 10.637, $p < .05$)

When looking at the sub-sample of Café participants only, differences by town mirrored those of the larger sample.

Three questions were used to better understand the nature of Café participation within the treatment group sample: 1) the number of years attending the Cafés, 2) Café attendance in the past year, and 3) membership on the YLT. The majority (62%) of treatment group respondents to the survey had been attending Café events for 1 year and about half (54%) reported attending “very few” events in the past year. Nearly a quarter (23%) of the treatment sample reported having been a member of the YLT in their town. See Table 5.

Table 5: Café participation within the Participant sample

Category	Percent of Sample
Number of Years Attending the Cafés	(n=167)
1 year	62%
2 years	30%
3 years	7%
4 years	1%
Café Attendance in the Past Year	(n=166)
Very few Café events	54%
About half of the Café events	19%
Most of the Café events	21%
All of the Café events	7%
Ever a Member of the YLT?	(n=145)
Yes	23%

Members of the YLT were significantly more likely than non-YLT members to have attended the Cafés for multiple years ($X^2(1, N = 139) = 20.907, p < .00$) and to have attended more Cafés in the part year ($X^2(3, N = 137) = 24.713, p < .01$). Members of the YLT were significantly more likely to have participated in the STEM program and a science club than were non-YLT members who attended the Cafés.

Since data for the participant sample were collected at two locations (Café events and high schools), analyses were run to compare the data collected from each group. There were no meaningful differences based on the data collection site for all demographic and psychographic variables with the exception of having a scientist in the family. Program participants who completed the survey at a Café event were significantly more likely than program participants who completed the survey at school to have a scientist in the family (48% compared to 26%; $X^2(1, N = 175) = 8.921, p < .05$). There were no differences between the samples based on data collection location for the Café-related independent variables (i.e. years attending the Cafés, Café attendance in the past year, and membership in the YLT).

Does engagement in the program group enhance youth participants'?

- a. Understanding of current STEM content and issues? (competence-cognitive)
- b. Sense of confidence and competence in their ability to develop and communicate factually supported positions on STEM issues? (confidence and competence-cognitive)
- c. Appreciation for and interest in STEM careers?
- d. Attitudes toward science, the process of science, and scientists?
- e. Personal development, such as growth in character, perceived contribution to their community, and leadership skills? (character, caring and compassion, contribution, competence-social)

Data related to the first evaluation question were collected using Likert-type ratings scales for a series of items (scale: 1=Disagree to 7=Agree). Items on the survey included science-related statements and PYD-related statements (See Table 6). Two levels of analysis were completed to answer the first evaluation question: 1) a comparison of the participant group to the non-participant group's ratings and 2) a comparison of the participant group's retrospective-pre-to-post ratings.

Table 6: Rating statements from the survey

Attitudes towards Science, Scientists and Science Careers	Positive Youth Development (“C” related to that statement)
Science is interesting	I have a good understanding of the process of scientific research (cognitive competence)
I like science	I have a good understanding of science issues that I hear about in the news (cognitive competence)
I am interested in the process of scientific research	When talking to others about science, I use facts to support my point of view. (cognitive competence)
I am interested in hearing more about science issues that are in the news	Before I make up my mind, I consider multiple sides of the issue (cognitive competence)
People should understand science because it effects their lives everyday	I am good at working with a team (social competence)
I can connect science to my daily life	When working on a team, I am willing to take on leadership roles (social competence)
Scientists make important contributions to daily life	I am confident speaking in front of a large group (social competence)
I know what scientists do	I respect people’s ideas that are different from mine (caring and compassion)
I am interested in talking to scientists about their work	I seek out opportunities to serve my community (contribution)
I know about a variety of careers in science	My actions can change the world around me (contribution)
I am interested in a science-related career	I feel confident sharing with others what I know about current science issues (confidence)
	I am a self-confident person (confidence)
	I have a positive future ahead of me (confidence)
	I will go to college (confidence)

Comparison of Participants and Non-Participants in the Café Program

Analyses indicate that the Café program succeeded at positively influencing attitudes about science. All the items designed to measure attitudes towards science, scientists, and science-based careers showed statistically significant differences between the participant and non-participant groups (See Table 7).

Table 7: Attitudes towards Science and Science Careers: Impact Ratings for the Café Program, Non-Participants compared to Participants (post-program ratings)

Item	Mean Rank		Sample Size		<i>U</i> value	<i>p</i> value
	Particip-ants	Non-Part.	Particip-ants	Non-Part.		
Science is interesting	195.26	171.07	172	192	14318.0	.023*
I like science	200.75	163.74	163	197	12754.5	.001**
I am interested in the process of scientific research	205.41	158.15	166	193	11801.0	.000**
I am interested in hearing more about science issues that are in the news	214.67	157.54	170	197	11531.5	.000**
People should understand science because it effects their lives everyday	197.94	173.82	171	198	14715.5	.024*
I can connect science to my daily life	199.11	168.64	172	193	13827.0	.005**
Scientists make important contributions to daily life	208.68	164.55	171	198	12880.5	.000**
I know what scientists do	205.55	155.14	165	191	11295.0	.000**
I am interested in talking to scientists about their work	212.91	153.69	170	192	10980.0	.000**
I know about a variety of careers in science	219.50	154.45	170	198	10880.0	.000**
I am interested in a science-related career	206.04	160.25	168	194	12173.0	.000**

Note. The Mann-Whitney *U* test was used to test for statistical significance.

* Significant at the $p < .05$ level. **Significant at the $p < .01$ level.

The results for the PYD-related items painted a more complex picture than for the science-related items. The Café program positively impacted participating youth's perceptions of their cognitive competence; when compared to non-participating youth, youth participating in the Café program rated these impacts significantly higher (Table 8). However, there were no differences in how participants and non-participants rated items related to social competence. Note that the majority of the cognitive competence items mentioned science, where as the social competence items were domain-free.

The item designed to measure the PYD concept of caring and compassion (within the dialogue-based format of the Café) was rated significantly higher by Café participants than non-

participants (Mann-Whitney $U=12618.5$, $N=348$, $p=.006$). One item designed to measure confidence (i.e. *I feel confidence sharing with others what I know about current science issues*) was rated significantly higher by Café participants than non-participants (Mann-Whitney $U=12093.5$, $N=367$, $p=.000$). There were no differences in how participants and non-participants rated the remaining confidence items or the items related to the PYD outcome of contribution.

Table 8: PYD: Impact Ratings for the Café Program, Non-Participants compared to Participants (post-program ratings)

Item	Mean Rank		Sample Size		U value	p value
	Particip- ants	Non-Part.	Particip- ants	Non-Part.		
I have a good understanding of the process of scientific research (cognitive)	203.98	163.47	171	193	12828.5	.000**
I have a good understanding of science issues that I hear about in the news (cognitive)	214.67	157.54	171	198	13349.5	.000**
When talking to others about science, I use facts to support my point of view. (cognitive)	203.25	165.35	170	195	13133.0	.000**
Before I make up my mind, I consider multiple sides of the issue (cognitive)	200.00	170.19	170	197	14024.5	.006**
I am good at working with a team (social)	168.05	182.30	167	183	14036.0	.167
When working on a team, I am willing to take on leadership roles (social)	167.84	177.68	164	181	13995.0	.334
I am confident speaking in front of a large group (social)	173.14	174.78	165	182	14872.5	.876
I respect people's ideas that are different from mine (caring and compassion)	189.48	160.83	166	182	12618.5	.006**
I seek out opportunities to serve my community (contribution)	180.82	166.75	166	180	13725.0	.180
My actions can change the world around me (contribution)	181.14	164.35	167	177	13336.5	.105
I feel confident sharing with others what I know about current science issues (confidence)	211.36	160.35	170	197	12093.5	.000**
I am a self-confident person (confidence)	178.88	172.38	168	182	14719.5	.531
I have a positive future ahead of me	183.62	165.17	166	181	13425.5	.059

(confidence)						
I will go to college (confidence)	182.32	166.54	164	183	13641.5	.065

Note. The Mann-Whitney U test was used to test for statistical significance.
 * Significant at the $p < .05$ level. **Significant at the $p < .01$ level.

To determine if participating youth differed from non-participants on science attitudes and PYD measures before starting the program, the non-participants' ratings were compared to the participants' pre-program ratings. This comparison showed very few significant differences. For the few items that did have statistically significant differences, (*Science is interesting, I can connect science to my daily life, I am good at working with a team, and When working on a team, I am willing to take on leadership roles*), non-participants had higher ratings. This demonstrates before starting the program, participants had very similar attitudes as those youth who did not participate.

Additional analyses were done to determine if independent variables such as demographics and participation in science-related activities resulted in differences between the participants and non-participants' ratings on the science-related and PYD-related items. Independent variables for which the ratings' between groups were significantly different were:

- Town
- Gender
- Year in high school
- Having a scientist in the family
- Number of adults in the household who attended college
- Number of employed adults in the household
- Number of high school science classes taken
- Participation in additional science-related extra-curricular activities

As stated previously, the differences between the towns in which the Cafés were held were readily apparent to the Café program staff during implementation. The impacts by town were different also, lending support to their hypothesis that the variable of town was important. When looking at the **science-related impacts** based on town, Albuquerque, Española/Pojoaque, and Los Alamos all demonstrated significant levels of difference between the participants and non-participants on the majority of items; Santa Fe did not. With regards to the **PYD-related impacts**, there were significant differences across some of the PYD items for all four towns when looking at participants compared to non-participants; however, there were no patterns within these differences that could be explained or isolated by town. Without identifiable patterns to the differences, this data does not help to explain how PYD-related impacts may vary between towns. Please see Appendix 2 for tables with the results for all independent variables.

→ *Summary of Café participant ratings compared to non-participant ratings: The Café program impacted the attitudes of participants towards science, science careers, and scientific thinking skills. When compared to their peers who did not participate in the Café program, program participants had higher ratings on aspects connected to science, science careers, and cognitive competence. However, very few of the PYD-related aspects were rated higher by participants as compared to their non-participating peers. All independent variables played a role in how the items were rated, indicating that many factors are involved in how the program impacted participants.*

Comparison of Participants Retrospective-Pre-Program and Post-Program Ratings

The study design also allowed for comparisons between the treatment's retrospective-pre and post ratings. When these data were analyzed, statistically significant differences were found between the retrospective-pre and post measures for all science-related items (Table 9) and PYD-related items (Table 10).

Table 9: Attitudes towards Science and Science Careers: Impact Ratings for the Café Program, Participants' Retrospective-Pre-Program Ratings compared to their Post-Program Ratings

Item	Mean		Sample Size	Z value	p value
	Retro-Pre	Post			
Science is interesting	4.8	5.7	160	-7.280	.000**
I like science	4.9	5.7	148	-6.654	.000**
I am interested in the process of scientific research	4.6	5.4	153	-6.488	.000**
I am interested in hearing more about science issues that are in the news	4.7	5.8	158	-7.065	.000**
People should understand science because it effects their lives everyday	5.1	5.7	157	-5.701	.000**
I can connect science to my daily life	4.8	5.7	156	-7.040	.000**
Scientists make important contributions to daily life	5.3	6.1	156	-5.108	.000**
I know what scientists do	4.8	5.6	147	-6.820	.000**
I am interested in talking to scientists about their work	4.8	5.7	153	-7.165	.000**
I know about a variety of careers in science	4.8	5.8	155	-7.294	.000**
I am interested in a science-related career	4.7	5.3	147	-5.764	.000**

Note. The Wilcoxon Signed-ranks test was used to test for statistical significance.

* Significant at the $p < .05$ level. **Significant at the $p < .01$ level.

Table 10: PYD Outcomes: Impact Ratings for the Café Program, Participants' Retrospective-Pre-Program Ratings compared to their Post-Program Ratings

Item	Mean		Sample Size	Z value	p value
	Retro-Pre	Post			
I have a good understanding of the process of scientific research (cognitive)	4.7	5.3	157	-6.401	.000**
I have a good understanding of science issues that I hear about in the news (cognitive)	4.4	5.2	157	-6.657	.000**
When talking to others about science, I use facts to support my point of view. (cognitive)	4.6	5.3	155	-5.231	.000**
Before I make up my mind, I consider multiple sides of the issue (cognitive)	5.1	5.7	155	-6.237	.000**
I am good at working with a team (social)	5.2	5.6	154	-4.287	.000**
When working on a team, I am willing to take on leadership roles (social)	5.3	5.7	150	-3.738	.000**
I am confident speaking in front of a large group (social)	4.6	5.0	152	-3.521	.000**
I respect people's ideas that are different from mine (caring and compassion)	5.6	5.8	153	-3.296	.001**
I seek out opportunities to serve my community (contribution)	5.1	5.4	153	-3.525	.000**
My actions can change the world around me (contribution)	5.2	5.7	154	-4.126	.000**
I feel confident sharing with others what I know about current science issues (confidence)	4.5	5.5	157	-7.431	.000**
I am a self-confident person (confidence)	5.4	5.7	155	-3.791	.000**
I have a positive future ahead of me (confidence)	5.8	6.2	153	-3.695	.000**
I will go to college (confidence)	6.2	6.4	151	-2.203	.028*

Note. The Wilcoxon Signed-ranks test was used to test for statistical significance.

* Significant at the $p < .05$ level. **Significant at the $p < .01$ level.

Additional analyses were done to determine if independent variables such as demographics, science activities other than the Café, and patterns of Café attendance resulted in differences in the change of ratings retrospective-pre-to-post within the participant group. Independent variables for which the ratings' change scores between groups were significantly different were:

- **Town:** On two PYD items (*Before I make up my mind, I consider multiple sides of the issue; I have a positive future ahead of me*), Española/Pojoaque youth participating in the Cafés had greater changes in their ratings over time than youth in the other towns.

- Membership on the YLT: On one science-related item (*I know about a variety of careers in science*) and two PYD items (*I am good at working with a team; I seek out opportunities to serve my community*), members of the YLT had greater changes in ratings over time than youth not on the YLT.
- Number of Years Attending the Cafés: For two science items (*People should understand science because it effects their lives everyday; I am interested in a science-related career*) and two PYD items (*When talking to others about science, I use facts to support my point of view.; Before I make up my mind, I consider multiple sides of the issue*), those who had been attending the Cafés for only one year had greater changes in their ratings over time than youth who had been attending Cafés for 2 or more years.
- Number of high school science classes taken: For two science-related items (*People should understand science because it effects their lives everyday; I can connect science to my daily life*) and two PYD items (*I respect people's ideas that are different from mine; I feel confident sharing with others what I know about current science issues*), there were differences in ratings over time due to number of classes taken; there was no apparent pattern to these differences.

Please see Appendix 2 for tables with the results for these independent variables.

The change score results for membership on the YLT and number of years attending the Cafés are contradictory. One would expect that more “in-depth” participation in the program (as defined by membership on the YLT and 2 or more years attending Cafés) would result in significantly higher ratings. This was not the case with regards to Café attendance. There are a number of possible explanations why the results for Café attendance run counter to what is

expected. It could be that there is a ceiling effect within the program, so that for those with longer participation have a leveling-off of impacts at a certain point. It is also possible that the method (retrospective-pre and post ratings) was biased towards newer participants; new participants could be better at identifying change because they are closer to it, while those participating in more than two years of the program no longer remember what their opinions were before they started attending Cafés. Both of these possibilities could create the pattern seen in the Café attendance data where those with 1 year of participation had greater change scores than those with 2 or more years of attendance.

→ *Summary of Café participant ratings retrospective-pre-to-post: Over time, Café participants reported that their attitudes towards science and their attainment of PYD indicators had changed. Very few independent variables had a meaningful significant impact on how participants rated the items pre-to-post. The data are inconclusive as to whether more “in-depth” participation led to higher changes over time. One of the four variables that did impact ratings was membership on the YLT. However, data also indicate more years of program participation was not linked to higher ratings.*

To what degree do youth feel a sense of belonging to and ownership of the Café community?

Café participants rated a series of six statements to better understand the degree to which they felt a sense of belonging to (the “C” of connection) and ownership of (the “C” of contribution) the Café community. The statements were rated on a 7-point scale (1=Disagree and 7=Agree). The highest mean rating was for *I feel comfortable coming to the Cafés* (See Table 11). This makes sense because feeling comfortable is a prerequisite for attending in the first place. If a teen

did not feel comfortable, they would not come. Overall, the statements designed to measure connection were rated higher by participants than the statements measuring contribution. Again, this makes sense because contribution is a “higher bar” than connection. The contribution statements also had standard deviations above 2.0, an indication that there was more variability in how participants thought about contribution to the Café community.

Table 11: Participant Ratings for connection and contribution to the Café program

Item	N	Mean	SD
I feel comfortable coming to the Cafés (connection)	164	5.8	1.689
Attending the Cafés is important to me (connection)	164	5.2	1.829
My ideas are respected at the Cafés (connection)	162	5.1	1.891
I have built closer relationships with my peers because of the Cafés (connection)	164	4.8	2.076
If I have an idea about how the Café should be run, I know who to share my idea with (contribution)	163	4.6	2.167
I have a say in what goes on at the Cafés (contribution)	164	4.5	2.100

It was hypothesized that those Café participants who had higher levels of involvement with the Café program would have higher ratings on the connection and contribution items than their less-involved peers. This hypothesis was true for two out of the three variables used to determine levels of involvement. Youth who were on the YLT had significantly higher ratings than non-YLT teens on two items (*If I have an idea about how the Café should be run, I know who to share my idea with* [U=1150.0, N=143, p=.001]; *I have a say in what goes on at the Cafés* [U=1220.0, N=143, p=.002]). Attendance at higher numbers of Café events over the past year yielded significant differences on every item as compared to lower attendance (Table 12). The number of years attending Café events did not impact how participants rated these items.

Table 12: Participants' Mean Ratings on Café-specific PYD Items by the Variable Number of Café Events Attended in the Past Year

Item	Number Attended				Significant Difference?
	Very Few (n=78)	About Half (n=31)	Most (n=33)	All (n=11)	
I feel comfortable coming to the Cafés (connection)	5.5	5.6	6.3	6.6	Yes, $X^2=10.133$, $p=.017$
Attending the Cafés is important to me (connection)	4.6	5.2	5.9	6.2	Yes, $X^2=15.520$, $p=.001$
My ideas are respected at the Cafés (connection)	4.8	5.2	5.4	6.3	Yes, $X^2=8.160$, $p=.043$
I have built closer relationships with my peers because of the Cafés (connection)	4.4	4.9	5.6	5.5	Yes, $X^2=8.947$, $p=.030$
If I have an idea about how the Café should be run, I know who to share my idea with (contribution)	4.0	4.7	5.4	5.8	Yes, $X^2=15.046$, $p=.002$
I have a say in what goes on at the Cafés (contribution)	3.8	4.8	5.2	6.3	Yes, $X^2=20.238$, $p=.000$

The independent variable of the town in which the youth participated in the Café program was significant for only one item (*I have a say in what goes on at the Cafés*). Española/Pojoaque participants rated this item higher than participants at the other three sites ($X^2 (3, N = 163) = 7.829, p=.050$).

An analysis based on the demographic variables, found significant differences for three items:

- *I feel comfortable coming to the Cafés*: significant differences based on:
 - Having a scientist in the family, with those with a scientist rating this item higher ($U=2334.5, N=159, p=.010$).
 - Year in high school, with seniors having higher ratings than those teens in other grades ($X^2 (3, N = 150) = 9.318, p=.025$).

- Number of employed adults in the household, with those teens with employed adults rating their comfort higher (X^2 (3, N = 160) = 8.796, p=.032).
- *My ideas are respected at the Cafés*: significant differences based on:
 - Year in high school, with juniors and seniors having higher ratings than freshmen and sophomores (X^2 (3, N = 148) = 14.446, p=.002)
 - Number of employed adults in the household, with those teens with employed adults rating their comfort higher (X^2 (3, N = 158) = 11.412, p=.010).
- *I have built closer relationships with my peers because of the Cafés*: significant differences based on:
 - Year in high school, with juniors having higher ratings than those teens in other grades (X^2 (3, N = 150) = 10.927, p=.012).

→ *Summary of Café participants' sense of belonging and ownership: Youth who attended the Café program were more likely to feel that they belonged or were connected to the Café than to feel a sense of ownership or contribution to the Café. Youth's Café attendance over the past year was the variable that had the biggest impact on how youth rated these items; higher attendance led to feeling more connected and able to contribute. Despite differences in how participants from each town rated the science-items and other PYD items, town did not appear to be a very big factor in youth's perception of belonging and ownership.*

The Program Model

To better understand the program model, focus groups with youth participants, adult program staff, and scientist-speakers were conducted. This method allowed for a holistic approach to understanding the model. At the same time it does not represent a consensus among participations. The program model is explored below using three perspectives: elements of the program model, site differences and the role of multiple sites in the model, and the net-value of the Café model.

Elements of the Program Model

The Café Scientifique program, like any program, is made up of a variety of program elements, i.e. resources or “moving parts”. In the focus groups, members of the YLT, scientist-speakers, and program staff members identified the most essential elements of the program. Across the focus groups, there was agreement on the primary elements of the Café model: the people involved, topic selection and speaker preparation, and qualities of the Café events. Each programmatic element is detailed below.

The Human Factor: People Involved in the Cafés

There was overwhelming agreement in the focus groups that the most essential elements in the Café program model were the people involved, namely the program staff, scientist-speakers, and the youth. Each group played a critical role in the implementation of the program.

Program Staff: Both the program staff and the YLT participants felt that the program staff were essential to the program model. The project’s PI felt that having a “competent leader in

each town” was necessary to “get the program going and [motivate] their youth leadership teams to do it.” Program staff members as site leaders were responsible for the logistics of hosting the Café events at their site as well as recruitment and management of the YLT, advertising, and interfacing with the local schools. The program staff members were the “champions” of the program. Youth agreed that the program staff were critical to the smooth operation of the program. Members of the YLT viewed the program staff as the organizers and supervisors. They ensured that things run smoothly and on time and deal with logistics, such as food, building access, and group management. In the role of supervisor, youth said that the program staff ensures that tasks are delegated and carried out accordingly. Youth participants emphasized that without the adult leaders, Café scientifique “wouldn't happen at all.”

Scientist-speakers: Scientists involved with the program felt their role was to represent current science topics and science careers to the youth participants. One scientist thought that high school does not give youth a good idea of what science is, saying, “I don't think they get the sense of excitement that basic science has for basic scientist.” She felt high school science emphasized facts and not the process of science or how science is helping to solve society's problems. As speakers at the Cafés, scientists felt they could help youth to consider the possibility of going into a science career by helping them understand what it is scientist do and how rewarding they find their work. Youth echoed the thoughts of the scientists when they reflected on the role of the speaker and what made for a good speaker. The teens viewed the speakers as the “main attraction” of the Cafés. The scientists, youth said, are “specialists” in their field and able to talk about science from personal experience (which is different that

teachers who are more generalists and who are mostly occupied with teaching). When asked what makes for an ideal speaker, participants said the scientist needs to speak with humor, make good use of examples and illustrations, and be able to discuss complex science topics at a level that youth can understand. Youth also appreciated speakers who were passionate about their work.

Youth Leadership Team: While many of the activities that YLT members do could be done by the program staff, a unique aspect of the program is the involvement of youth in the planning, organizing, and running of the program. Program staff felt that youth leaders were essential to the model. "I wouldn't do this without youth leaders," said one program staff member. Another staff member felt "the program is empowering the teens [on the YLT] and having it be their program." They felt that to be a successful program, the Café had to have a "core culture" of teen leadership. When asked to describe the role of the YLT, YLT members explained how they often perform managerial or operational tasks, ensuring the Cafés run smoothly (setting up chairs, creating a nice ambience, sign in guests, introduce presenters, clean up). One person emphasized their role as marketers or advertisers, adding that "it's good to have youth running the program... it gives a more down to earth approach to this as opposed to a bunch of adults at a school teaching you science." Youth felt they were able to help with recruitment because they could tell their peers about the Café. When asked what makes them different from other non-YLT teens, one participant said that YLT members are called upon to speak in front of an audience and have direct communication with the scientists. Another teen said that the YLT students have more "freedom" and act as "leaders."

In this role, YLT members often have to enforce standards of good behavior, such as getting other teens to stop talking.

Youth Attendees: What program can exist without an audience? Members of the YLT thought the youth audiences who attend Café events contribute by making the speaker feel appreciated and valued, and by making the environment more social and lively. The program staff and scientists felt that the program is not designed just for teens who already know they are interested in science. "I think the whole idea of bringing it to teens is to expose all of them to what's out there," said one scientist. Another said,

Because I think there are tons of kids who have no idea what interests them yet, and they're looking around for what's gonna interest them, and you know, this could be the opportunity to spark them to be interested in science.

The scientists, program staff, and YLT members agreed that while the youth attendees to the Cafés do not have to be science-interested, they do have to be interested in participating in the Cafés. Teens in the focus group also observed that the youth audience contributes more when they are respectful and engaged, asking thoughtful questions of the presenter.

Topic Selection and Speaker Preparation

Selecting topics that will be of interest to teens and preparing the scientist to speak with the teens are important aspects of the Café model. Teens on the YLT felt that having a scientist speak about their work was at the heart of the Café. "If they don't speak about their work, there's no Café," replied one teen. Another teen said, "That's the point of the Café - to talk to us about their job and interest us in future careers in science." Hearing a scientist talk not

only about a subject, but also their personal experiences and feelings towards the topic and their career is highly valued and appreciated by YLT teens. In general, the teens thought the topics selected were important in motivating other youth not on the YLT to attend Cafés. While some topics may be "important" (such as global warming), they stressed that it is topics considered interesting and relevant to teens that draw the greatest crowds (like the computer hacking). Other youth took a slightly different approach to selecting topics, saying in the words of one teen, "content doesn't really matter as long as people find it interesting." Prior program evaluations found that topics considered to be "controversial" were viewed by the YLT members as easier to discuss. However, in this use "controversial" meant topics that had multiple easily discernable points of view, not necessarily salacious or polarizing issues (Foutz, 2008a).

Scientist views on the topics selected generally matched those of the youth. They felt the topics should be current and relatable to youth and cover a broad range of disciplines or fields. When asked about the role of controversial topics in the Café, one scientist who spoke on what could be a controversial subject said "I don't think you should shy away from it, but I think [there needs] to be a basis for doing it." It was also important to the scientists that they speak about their own research or work (as opposed to science issues outside of their field). They felt that speaking about their own work was "more fulfilling" and carried weight with the teens because they were experts in what they were talking about. Plus, scientists felt when they were talking about their own work, they were more passionate.

Preparing the speakers to talk with teens was a key element of the program. Although they were passionate and interested in their work, many of the scientists did not have much prior experience in presenting to teens or other non-expert audiences. They admitted that presenting to a “lay audience” meant that they had to either explain or eliminate the “jargon” they typically use. One aspect of preparing the scientists that was mentioned repeatedly in the focus groups was the value of doing a dry run of their presentation. At various times in the program, the dry runs were given to program staff, other scientists, or members of the YLT. Scientists felt the dry runs were helpful in allowing them to get feedback on “what would be the most interesting for kids,” areas where they would need to add more background information, and how to frame their work in the larger context. As one scientist put it, he had to think about, “What are the issues? What are the problems? And how does my research fit into the bigger picture?...I think I never worked so hard on a talk in my whole life.”

The Cafés

There were many aspects of the Café events themselves that were seen as important to the youth, scientists, and program staff. These included the level of interactivity in the Cafés, the incentives used to encourage youth attendance, and the use of technology during the presentations.

Interactivity within the Cafés: The scientists and program staff felt that interaction between the scientists and the teens is at the heart of the Café program. In the words of the project’s PI: “It’s the people interaction, that chemistry between the kids and the scientists and how we make that happen between them that makes the Café.” In one focus group there was some debate about how to best foster this interaction. Were hands-on activities

necessary? Or was the discussion format more essential? In the end the group agreed that talking with a scientist in a discussion format was more essential to the model than hands-on activities. As one scientist put it, “It’s important for the kids to have a chance to discuss to engage about the science.” Dialogue was seen as an indispensable part of engaging with a Café topic. Surprisingly, youth felt less strongly about the need for discussion within Cafés than the scientists and program staff did. Youth felt the discussions were good in that they allowed youth to get their questions answered and helped to create a more social environment. However, it seemed that many members of the YLTs were very aware that the discussions had the potential to go off-topic or be what they considered “low quality.” For example, at one site a youth leader commented that, “It’s a little bit embarrassing, actually, if they ask like a really dumb question. Because then it like reflects on our whole like group and our whole town.” However, despite the difficulties in fostering rich discussions between teens and scientists, the dialogue is a critical component of the traditional science Café model.

Incentives for Attendance: A number of items were listed by the youth and adults in the focus groups as “nice to have” but not essential elements to the program model. This included the many incentives that are used to encourage youth to attend. One scientist called them “carrots” that get the youth in the door. This included items provided by the Café program such as food, door prizes, and money for car pooling, as well as the extra credit that some teachers gave to students for attending. In prior evaluations members of the YLT were very clear that the incentives are an important for driving attendance (Foutz, 2008a). However, in the context of the other elements of the program model, the incentives were

viewed by youth as somewhat less important. Scientists and program staff felt that the extra credit was the most problematic incentive. While it was very important in terms of building an audience, it also led to issues. This included teens who attended purely for extra credit and were disruptive during the presentations and/or did not engage in the discussions. However, in some cases, like at the Albuquerque site, teens who get extra credit for attendance form the core of an excited and engaged audience.

Use of Technology: In the focus groups, YLT members and scientist-speakers commented on the relative value of using technology (i.e. PowerPoint) during the presentations. In listing elements that support the Café model, the youth often included PowerPoint, computers, and projectors as items one would need to host a Café event. However, there was some ambivalence among youth on the topic of using technology to support a presentation. They said that PowerPoint was often used, but they did not appreciate it when it was used poorly by the presenters. One YLT member from Española commented, “There are some speakers that are just reading everything off the board, and we’re just like ‘I can read.’” When it was used well, though, they thought PowerPoint was quite valuable, especially for the visuals that speakers use. Scientists tended to agree that the value of the PowerPoint was the visuals that could be used to support a talk. But they also felt PowerPoint was expected by the teen audience. One said, “I think the kids would be disappointed without [PowerPoint]...I think it’s easier to bring kids along with it.” Overall, it appears that while technology-supported presentations are common in the Café format, they are not essential to the model; an excellent talk can be given without PowerPoint, and a less-than-excellent talk can be given with PowerPoint.

Site Differences and the Role of Multiple Sites in the Model

A key distinguishing feature of the Café model was the implementation of the program at four towns or sites in New Mexico: Albuquerque, Española/Pojoaque, Los Alamos, and Santa Fe. Throughout the program's three years, the program staff repeatedly commented on the differences they perceived between the sites. They spoke of variations in the economic situation in the towns, the disproportionate access some towns had to quality education and extra-curricular activities, and the differences in the culture of science across the four sites. One goal of the summative evaluation was to determine to what degree programmatic impacts might be different across the sites (through the quantitative analysis of the surveys) and to further investigate differences in implementation across the sites (through analysis of the focus groups).

There were some very concrete differences between the Café sites. Program staff in the focus groups spoke of how the Santa Fe site never developed a core group of teens who helped “set the tone” of the Café. Despite using methods for recruitment that worked well in the other towns, the Santa Fe site lacked a consistent audience from Café to Café, with some events having very low attendance. Based on the evaluator's observations, the Albuquerque and Española/Pojoaque sites had very low turn-over on the YLT from program Year 2 to Year 3. This would have created a very different culture than at a site with higher turn-over. Additional factors that differentiated the sites had to do with venue and audience size, with multiple sites struggling to accommodate increasingly large crowds.

The focus groups with program staff and scientist-speakers revealed additional information on the perception of the differences between the four towns. At least in the case of the scientists, it seems as though the differences between the towns were largely confirming of the perceptions they had of each site before joining the program. Scientists talked about how they felt differently about certain towns based largely on the reputation of the area. “I loved Española,” one said, “and I was kind of expecting to love it going in, ‘cause I’m always kind of rooting for the underdog, and Española’s the butt of a lot of jokes in the state.” This scientist went on to comment that he felt the youth at Española appreciated his talk a lot more. Another scientist in the focus group spoke of how the teens at Los Alamos were more “self-directed...almost like I didn’t need to be there.” Another scientist said the Los Alamos youth seemed more “focused.” There was general agreement that the youth in Los Alamos take science as a “given” because “they hear it every night at dinner.” Of course, this is an over-generalization, as not every youth in Los Alamos has a scientist in their family.⁴

This idea of what was “typical” for each town in the Café program was much better understood by the program staff. As one might expect, with the amount of interaction the staff had with the youth, they were better positioned to describe their sites. These descriptions were based in terms of the actual behaviors of the youth and not generalizations about the town. When one scientist mentioned that an advance organizer from the program staff on what to expect in each town would be useful, the project PI reminded him that she did provide this overview. “But from my perspective you’ve never talked to teens,” she explained. “So that when I tell you some of these

⁴ Participants from Los Alamos were significantly more likely than youth in other towns to have a scientist in their family ($X^2(3, N = 173) = 39.604, p = .000$). However, 34% of Los Alamos Café participants did not have a scientist in their family.

things, it's like, 'Okay so—so what does that mean?'" At this point in the focus group, scientists said they remembered this type of overview as they were preparing their presentations, but that at the time it was so de-contextualized as to not be actionable. As one scientist put it, "In my mind, they're just a bunch of teenagers." It does not appear, however, that the differences between sites resulted in differences preparation for the scientists as they prepared to speak in each town. While the actual interactions in each town might have been very different, scientists generally prepared to speak in the same way regardless of the town.

When asked if it was important to the model to involve multiple sites, the focus group participants thought that a multi-site approach was important. From the speakers' point of view, benefits of multiple sites included, 1) allowing for the scientists to improve by giving their presentation multiple times, and 2) getting "more bang for their buck" in terms of providing more opportunities to interact with youth. This was important because of the time it took to prepare to present; spending 6-8 hours preparing for just one talk would be much less appealing for the presenters in terms of the return on the time invested.

Focus groups on the nature of the Café model also were conducted with members of the YLT in each town. Taken as a whole, there were very few differences in how the teens on the YLT in each town perceived the benefits, challenges, and essential elements of the Café program. The differences seemed to be in the emphasis the youth put on various aspects of the program model. For example, the YLT members in Albuquerque felt that one of the most essential elements to implementing the Café program was advertising. YLTs in the other towns listed advertising as important, but it was not as important to them as it seemed to be to the Albuquerque YLT. While

there may have been few differences between the content of the responses from the YLTs of each town, there were differences in the richness of responses. The researchers noted that not only did Santa Fe have fewer participants attend the focus groups, but that they did not seem to be as engaged or have as much program buy-in as youth in the other towns.

In terms of benefits and motivations for program participation, the social aspect seemed to be primary for youth on the Española/Pojoaque YLT, while it was a secondary consideration for other YLTs. Youth on the Española/Pojoaque YLT (in prior focus groups) were also the only ones to mention that the Café offers them something to do in a town that doesn't have much going on other than Wal-Mart. There was a sense of pride among the Española/Pojoaque teens about being a part of something positive and unique in their town. This sense of pride was missing in the other towns even though the YLT members in other towns were also highly invested in the program.

The primary difference between sites that was revealed through the YLT focus groups was how the members of the YLT felt about their site leader, the program staff member who served as their main point of contact. In describing the role of the program staff as site leaders, members of the all four YLTs viewed the program staff as the organizers and supervisors. However, the youth in Española/Pojoaque were the only ones who described the site leader as their “second mother”. The following quotations from these youth capture their feelings for their site leader:

It's like really easy, we developed a connection with her, and she's like – we could talk to her easily.

She's like a teen at heart and she understands where we're coming from.

Because we've all got used to her and everybody on the leadership team is like family. So all of us are family...

The Española/Pojoaque site leader had contact with the kids outside of the Café too. This close connection between the YLT and the site leader at Española/Pojoaque could have been a result of a number of factors such as 1) her approachable nature, 2) the mood she helped foster at the Café, 3) the fact that her high school-aged children were on the YLT, or 4) the distinct need of the youth at Española/Pojoaque for an adult mentor in their lives. This relationship between the program staff and teens, described by the teens as a “family,” may have been unique amongst the Café sites but is not unique among PYD programs.⁵ The degree to which this relationship translated into programmatic impacts such as attitudes towards science or PYD outcomes is impossible to determine. However, it may certainly have accounted for the continued involvement and success of the Española/Pojoaque youth on the YLT.

While the other sites may have lacked this type of relationship between youth and site leader, it did not seem to prevent other sites (Albuquerque and Los Alamos) from being successful. Santa Fe, the least successful site in terms of building a consistent core of attendees, may have benefited from a closer relationship between youth and staff. However, such a relationship is impossible to force and the lack of a “family” atmosphere certainly does not account for the

⁵ See Wenger & Foutz, 2010; Monford, 2010.

difficulties encountered at Santa Fe. Given the success of the sites with different types of leader-youth relationships, it seems that this type of relationship is not central to the Café model. What is essential, however, is creating a welcoming, social atmosphere—an important element of the model articulated by all YLTs during the focus groups.

The Net-Value of the Program

In determining the net-value of the Café Scientifique program, it is necessary to look at the benefits and the challenges of the program in context and whether the program's mission is being met.

Program Benefits

Both scientists who were speakers in the program and members of the YLT were asked to describe the ways the program has benefited them personally. There was wide-spread agreement among the scientist-speakers that the program had personal benefits. Four benefits were mentioned by participants in both scientist focus groups: 1) the personal satisfaction that comes from doing outreach; 2) the opportunity to share their enthusiasm for their work with the teens; 3) to practice presenting their work at a level that is different from how they present to their peers; and 4) the opportunity to think differently about their research and how it connects to the broader field or society.

Teens on the YLT were able to talk about the benefits of the Café program on two levels: 1) as attendees of the presentations and 2) as members of the YLT. When reflecting on benefits of attending the presentations, participants talked about the benefit of being introduced to and learning about science and that the Cafés are a unique experience that they cannot get in school. A few people emphasized the benefit of getting to engage in hands-on activities and

interact with real objects, such as the brain and human bones. One youth called these types of experiences "active learning." Explaining more why those types of active learning experiences are so valuable, participants said that you gain richer memories and that you often "change your perspective." Another benefit participants discussed was getting to talk with real scientists who have passion for their careers, which, they say, increases their own interests in science. Youth also said that learning about science in the Cafés is fun - different than the typical school learning. When reflecting about benefits that come from participating on the YLT, participants described a range of benefits, including gaining leadership experience, increasing focus and concentration, and improving public speaking skills: all of which, they say, "look good on a resume." Another benefit of the YLT is that participants have choice and control over their learning experiences; they get to "have a say" in the choice of topics and the organization of the Cafés.⁶

Program Challenges

Program staff, scientist-speakers, and youth participants spoke about the challenges of organizing and participating in the program. For program staff, the challenges were characteristic of informal education programs and programs relying on support from schools. These included issues such as recruitment and retention; the logistics of a regularly scheduled program; communication with and follow through of members of the YLT; and fostering buy-in from the schools. While these challenges existed at all sites, the severity of these challenges was highly site-dependent.

⁶ See the formative evaluation reports for more on the appeal of the program and perceived benefits of program participation for youth (Foutz, 2008b; Foutz, 2009; Lelliott & Foutz, 2009).

Challenges for the participating scientists included the time required to prepare their presentations and the travel to multiple sites. Multiple scientists in both focus groups mentioned the time they invested in the program. The preparation of their presentations took scientists on between four and eight hours, including the dry-run. However, they also had to prepare materials for the website like their biography and a description of their talk. Traveling to multiple sites spread across a large area took time and was an inconvenience for many scientists. There was an indication by the program leaders that being asked to travel to four sites was a barrier to participation for some scientists; this led to a team approach where two scientists collaborated on preparing one talk. Then each member of the team gave a presentation at two sites. Despite this time investment, there was a sense among members of both scientist focus groups that the Café program was worth it, as explained by one scientist: “It takes a lot of energy and effort...but it was really, really rewarding...I got a lot out of it.”

Teen participants on the YLT felt that there were challenges relating to their own participation and to the participation of other teens. As members of the YLT, teens had logistical and planning issues, such as early meeting times that conflict with after-school activities and homework commitments, and high expectations that they will attend every meeting. In terms of the participation of other teens, some members of the YLT felt that the biggest challenge is getting the youth audience to "pay attention" and act "respectfully." The YLT act to check the behavior of their peers during the presentations, and a few felt it was difficult to be in the position of authority over other teens. Others said that finding ways to

stimulate the audience's interest in science topics and motivating them to attend programs is challenging.

Overall, when looking at the net-value of the program, *A Youth-Directed Café Scientifique* is worth while endeavor for program participants. Scientist-speakers and program staff agreed that the program was meeting its goal to:

Interest youth in science and to do that by bringing scientists – active scientists, [to] talk about what they do in an informal way where the youth have ...a lot of control and can put a lot of questions, and hopefully make them interested in science, perhaps to follow careers – [or] at least understand science better.
(Scientist-speaker)

The adults involved with the program thought the Cafés successfully engaged youth as shown by the teens' "enthusiasm and [they] ask a lot of appropriate questions." They also felt that teens were willing to debate and discuss controversial issues. These indications, taken together with the results of the quantitative study, build a picture of a program that is successful at supporting youth's interest in and attitudes towards science and science careers, and critical thinking skills around current science issues.

Conclusions

The most essential elements of the Café model are the people involved (Program Leaders, Scientist-speakers, YLT, and youth attendees) and the implementation of the program at multiple, diverse sites. The program is successful because the benefits of participation outweigh the challenges for both the youth and the scientist-speakers.

Evaluation data showed very clearly that the Café program did influence participants' attitudes towards science. Data comparing the ratings of participants to non-participants and the retrospective-pre-to-post ratings of participants, demonstrated that program participation resulted in higher ratings of interest in science, knowledge of scientists' work, interest in science careers, and cognitive competence towards science.

There were, however, mixed results as to the program's impact on PYD outcomes. Comparisons between the control and treatment groups on the PYD outcomes of social competence, caring and compassion, contribution, and confidence showed no difference. However, youth's retrospective-pre-to-post ratings reported that there was significant programmatic impact on these PYD outcomes. These mixed results lead to a number of possible interpretations. It is possible that participants felt there was a change in these PYD areas where (objectively) there was no change. It is also possible that the results are more a reflection of trying to measure PYD than of the program itself. As the teenage years are ones of growth and maturation in general, it may be that participants attributed to the program what amounts to natural change. It is also possible that the program did have an impact on participants' social and internal capabilities, and

that such a personal process may best be judged by the individual's progress and self-report, making any comparison to a control group difficult.

There were clear differences between the sites based upon both the quantitative and qualitative data, with the Santa Fe site standing out as the most different. Quantitatively, the science-related ratings showed that Albuquerque, Española/Pojoaque, and Los Alamos all demonstrated significant levels of difference between the participants and non-participants on the majority of items; Santa Fe did not. Qualitatively, program staff acknowledged that Santa Fe had issues related to recruitment and retention. This study used multiple methods to explore differences between the towns, and the data confirm what staff already suspected: there are differences between the towns. However, these differences are a rich combination of site specific factors that could not be reduced or explained by program staff or the data. What ultimately makes one site successful while another falters is a combination of multiple variables (perhaps known in advance), the interaction of which can not be predicted until the program is implemented.

References

- Catalano, R.F, Berglund, M.L., Ryan, J.A.M., Lonczak, H.S., & Hawkins, J.D. (2002). Positive youth development in the United States: Research findings on evaluations of positive youth development programs. *Prevention & Treatment, 5*(June 24).
- Eccles, J., & Gootman, J.A. (Eds.). (2004). *Community programs to promote youth development*. Washington, DC: National Academy of Sciences.

- Foutz, S. (2008). *A Youth-directed Café Scientifique: Formative Evaluation Year 1, Focus Groups with Youth Participants*. Unpublished technical report. Edgewater, MD: Institute for Learning Innovation.
- Foutz, S. (2008). *A Youth-directed Café Scientifique: Formative Evaluation Year 1, Online Formative Survey*. Unpublished technical report. Edgewater, MD: Institute for Learning Innovation.
- Foutz, S. (2009). *A Youth-directed Café Scientifique: Formative Evaluation Year 2, Focus Group Impact Study*. Unpublished technical report. Edgewater, MD: Institute for Learning Innovation.
- Lehr, J.L., McCallie, E., Davies, S.R., Caron, B.R., Gammon, B. & Duensing, S. (2007). The value of “Dialogue Events” as sites of learning: An exploration of research and evaluation frameworks. *International Journal of Science Education*, 29(12), 1467-1487
- Lelliott, T., & Foutz, S. (2009). *A Youth-directed Café Scientifique: Formative Evaluation Year 2, Online Formative Survey*. Unpublished technical report. Edgewater, MD: Institute for Learning Innovation.
- Lerner, R.M., Lerner, J.V., Almerigi, J.B., Theokas, C., Phelps, E., Gestsdottir, S., Naudeau, S., Jelicic, H., Alberts, A., Ma, L., Smith, L.M., Bobek, D.L., Richman-Raphael, D., Simpson, I., DiDenti Christiansen, E., & von Eye, A. (2005). Positive youth development, participation in community youth development programs, and community contributions of fifth-grade adolescents: Findings from the first wave of the 4-H study of positive youth development. *The Journal of Early Adolescence*, 25(17), 17-71.
- McLaughlin, M.W. (2000). *Community counts: How youth organizations matter for youth development*. Washington, DC: Public Education Network.

Monford, R. (2010). Finding a second family. *ASTC Dimensions*, March/April 2010, 5.

Wenger, A., & Foutz, S. (2010). A journey with CAUSE: Putting Positive Youth Development into museum youth programs. *ASTC Dimensions*, March/April 2010, 3-4, 8.