YOUTH RADIO

Science and Technology Program Evaluation

Submitted by:

Rockman et al

Independent · Insightful · Informative

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YOUTH RADIO

Science and Technology Program Evaluation

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"…there's something in Youth Radio that fosters this sense of curiosity whether it's about science or whether it's about politics or whatever it is. But it fosters and cultivates a sense of curiosity about the world in which we live that leads to these young people asking questions, really asking the things that they want to know…."

-- David Pescovitz

Program Overview

Youth Radio, an after-school media production program, consists of a main campus in Oakland, CA, and regional bureaus in Atlanta, GA, Washington, D.C., and Los Angeles, CA. Youth Radio's model is to engage underserved young people in broadcast journalism, radio and web production, engineering, and media literacy through media projects that are relevant to the students' lives and communities. In doing so, Youth Radio prepares young people for college programs and careers in media. The organization also supports young people in their transition from school to career through an externship program that offers students job shadowing and mentoring in media, technology and social justice institutions.

Oakland. Youth Radio Oakland is housed in a state-of-the-art, digital media production and distribution facility. The Oakland program offers a series of training programs for 14-18 year old students. The introductory Core program emphasizes basic media production and journalism skills and allows students to gain some experience with multiple areas of production, including radio broadcasting, commentary writing, music programming and production, and web and video production. In the intermediate Bridge program, students specialize in one of these areas. After completing these skills classes, students choose from a range of internships, including: peer teaching, newsroom, Webroom, technology, health, and development/administration. Youth Radio also offers a Community Action Project (CAP) program in leadership, education and media training for at-risk high school youths and an Emerging Media Professionals program for 18-24 year olds.

Atlanta. Youth Radio Atlanta operates as an after-school, radio journalism program at Grady High School. Students write commentaries which air weekly on the local public broadcasting station, WABE 90.1 FM. Students write the stories and then record them at the station. Youth Radio staff prepare the stories for airing and deliver them to the station. The Atlanta bureau staff also conducts radio and journalism workshops with area youths and organizations.

Los Angeles. Based at NPR West, Youth Radio L.A. operates a mix of journalism workshops and an informal newsroom for interns. Most recently, this bureau conducted a weekly workshop in an English class at Jordan High School in which students learned the basics of conducting and recording interviews and writing for radio. L.A. News interns work largely independently on stories with input and assistance from staff. They meet at an Art Share space twice a week to discuss story ideas, do research, and get input from both staff and each other. Students' stories appear on the Youth Radio website and blog, as well as through local (on KCRW 89.9 FM and KPCC 89.3 FM) and national media outlets. Youth Radio L.A. interns also participated in an innovative, community journalism project called Mobile Youth Voices (featured as part of the Science Journalism case study below).

Washington, D.C. Youth Radio DC is based out of the Latin American Youth Center's Art and Media House, and can be heard locally on WTOP 820 AM & WTOP 104.3 and WETA 90.1 FM. This bureau primarily covers public affairs stories for Youth Radio.

The bureaus produce news stories independently and also collaborate on stories with the Oakland branch. Each location leverages unique resources and opportunities while maintaining a focus on the primary Youth Radio goals of empowering young people to express themselves through media creation.

Evaluation Overview

In 2006, Youth Radio received funding from the National Science Foundation to create a Science and Technology Program that would substantially increase their students' interactive engagement with STEM issues and expand the advanced technology training opportunities available to these youths. Researchers from Rockman et al (REA), the external evaluators, were charged with documenting Youth Radio's efforts over the course of the grant and reporting the program's achievements. REA staff worked closely with the Oakland program over the three years of the NSF grant and collected survey data from each bureau. In Year 3, REA staff conducted a site visit in LA and a series of phone interviews with students and staff in Atlanta.

The evaluation explored Youth Radio's model for engaging underserved young people with STEM learning through the gateway of hands-on media production. This report describes the process whereby Youth Radio successfully integrated into its existing programming STEM-related activities that were relevant for youth, insightful for staff and sustainable for the organization.

In the early stages of the grant, evaluators studied Youth Radio's central mission and programming as well as its early attempts to bring STEM experiences into digital media education. Analyses considered the students' overall experiences in the program and its effects on their skill development and career goals. Later as more STEM-related activities were enacted, the evaluation changed in several ways. It became apparent that the grant

was changing Youth Radio's approach to partnerships and staff's attitudes toward science and STEM teaching long before it affected youth knowledge, attitudes and skills. REA therefore expanded the scope of their evaluation to include effects on staff and organizations (i.e., Youth Radio and its partners).

STEM case studies. To highlight the STEM initiatives Youth Radio expanded and developed as a part of the NSF grant, REA conducted a series of case studies. This approach allowed evaluators to explore the changes and outcomes of the grant at multiple levels – the organization and staff, the external partners, and the students.

The Technology case reviews the technology and engineering training offered to students, as well as the new opportunities afforded when Youth Radio moved to a state-of-the-art digital production facility and made new partnerships in the tech community. The Science Journalism case examines the STEM stories and projects produced by Youth Radio Newsroom interns. The Brains & Beakers case explores this innovative new program developed by Youth Radio to engage Core students with local scientists and inventors. Finally, the STEM Partners case examines two initiatives in which Youth Radio partnered with local entities, including the California Academy of Sciences and an innovative, technology-based journalism project entitled Mobile Youth Voices.

Data Collection

Evaluators had ongoing conversations with Youth Radio staff about the activities they were doing and how these activities were being received. They conducted site visits and program observations to see for themselves what was happening. They arranged youth focus groups and interviews to get their perspective on Youth Radio in general and STEM programming in particular. They collected artifacts such as news stories, commentaries, videos and production notes to understand the products the youths were creating. During the final year of the evaluation, these data collection activities primarily served the case studies on STEM initiatives. Finally, REA staff analyzed course evaluation surveys completed each quarter in Core, Bridge, internships and Bureaus. All instruments can be found in the appendix.

Surveys. Youths completed program evaluation forms at the end of each class. The forms asked students mostly closed-ended questions rating different aspects of the program including overall quality, opportunities to work with peers and staff, and opportunities to learn about community issues. Participants were also asked to identify what they had learned from the program by selecting choices from a list of items.

Artifacts. Student radio commentaries and stories were collected and content analyzed for themes related to science, technology, engineering or math as well as for evidence of the standards of science journalism. Stores and production materials (such as interview notes and question drafts) were also collected for stories featured in case studies.

Focus groups. Over the period of the grant, a series of focus groups were conducted with Core, Bridge and CAP students approximately every other quarter, and periodically with interns. Each focus group lasted between 30 and 60 minutes and included between 3 and 9 young people. Each focus group addressed the students' overall perceptions of the Youth Radio programs, what they had learned and accomplished, their attitudes about science and technology, and their college and career goals. Other focus groups specifically addressed the science journalism curriculum and new STEM initiatives. Focus groups were also conducted during a site visit to the Los Angeles bureau and over the phone with the Atlanta bureau.

Classroom observations. Core and Bridge classroom observations were conducted in Oakland in 2007 and 2008 to capture both impressions of general training and specific STEM initiatives, such as a Core class preparation session for a Brains & Beakers event. REA staff also observed classroom and intern meeting sessions in Los Angeles.

Interviews. Interviews were conducted to provide an overview of the Youth Radio training programs and curriculum and as part of the STEM cases and site visits. These interviews encompassed both Youth Radio staff members and outside STEM collaborators and partners.

Results

Results are divided into two sections: quantitative analyses and case studies. The quantitative analyses describe general trends in program evaluation surveys administered over the three years of the grant. These trends are further illustrated with quotations from the periodic focus groups conducted with Core, Bridge and Intern students.

While the quantitative analyses provide an overview of program trends, the case studies provide in-depth descriptions of program activities and their subsequent effects on organizations, staff and students. Together, the analyses illustrate the range of programs conducted during the grant and the critical decisions that led to those programs' implementation and outcomes.

Quantitative Analyses

Core and Bridge students and Interns were given the opportunity to complete surveys each quarter beginning in the fall of 2006 and ending in spring 2009. The only two exceptions were spring and winter 2008, when the surveys were not administered. In all, there were 123 Core students, 79 Bridge students, and 187 internships. For the intern data, each case was an instance of an internship, not an individual student; each intern was able to complete one or more internships during their tenure at Youth Radio.

For the analyses below, we examined each of these three groups separately and utilized several types of statistical analysis including descriptive statistics, t-tests and analysis of variance (ANOVA). There were two time points of interest: (1) when Youth Radio moved from one facility to another larger and more well equipped facility in Spring 2007 (Core, Bridge, and Interns) and (2) when the Brains and Beakers curriculum was added (Core in Summer 2008 and Bridge in Fall 2008). We grouped the cohorts of students or interns before and after each of these time points to assess whether these large changes in Youth Radio influenced their survey responses.

General Program Outcomes

Overall Perception of Youth Radio

Youth Radio students were asked to rate their overall experience at Youth Radio on a five-point scale (i.e., 1= poor to 5=excellent). Based on the survey data, the core, bridge, and intern students averaged very high ratings (see table 1).

Table 1. Descriptive Data for Overall Experience at Youth Radio

Item: How would you rate your overall experience at Youth Radio? (Max score=5*)			
	N	Mean	SD
Core students	117	4.71	0.53
Bridge students	75	4.84	0.44
Interns	187	4.60	0.63

1= poor 2= needs improvement 3=average 4=good 5=excellent

Note: Intern sample size is based on number of cases, not number of students. Each intern has the opportunity to participate in several different internships.

In fact, 74% of Core students and 87% of Bridge students reported that they have had an "excellent" experience with Youth Radio. Sixty-seven percent of internships rated their overall Youth Radio experience as "excellent." Over two-thirds of both Core and Bridge students rated Youth Radio "excellent" for maintaining a safe and supportive environment and providing opportunities to learn from peers and staff. This positive experience with Youth Radio can best be summarized by the youth themselves:

> *Before I was in Youth Radio, I was out hanging with the wrong people, and doing the wrong stuff, and didn't really have a place to go . . . Youth Radio has definitely been an excellent experience for me. I have to say it has really impacted my life*
> *Yes, they believe in us. They're letting us say what we have to say, and they're listening and they're letting everybody else listen*
> *If we're doing a good job, they're going to make it happen, they can see it happen and they congratulate us*
>
> *I do think that the staff here is here to help you, and go over it with you, regardless of how difficult the circumstances are. So, it's definitely helped us a lot through the way.*

You always learn something new. If somebody's teaching somebody something and you're just on the side, somebody's going to come up to you and be like do you want to learn this, there's always an extra something you'll learn

I stopped and I came back and they're still here willing to help me. So, it's really a good opportunity and I'm happy that I took it seriously

Supervisor Evaluation

Interns also worked closely with supervisors who formed an advisory as well as supervisory relationship for the duration of the youth's internship. As youth were able to participate in more than one internship and the data were analyzed by internship, not by individual youth, table 2 shows the breakdown of youth by internship.

Table 2: Number of internships held (*N*=89 youth, 187 internships)

Number of internships held	Number of youth	% of Youth
4 or more	12	13%
3	14	16%
2	16	18%
1	47	53%

Interns were asked to rate the quality of instruction by their supervisor(s) using a 5 point scale. Due to changes in the surveys over the course of data collection, only one item regarding the quality of the supervisor's constructive feedback was assessed on all surveys (n=150). After Fall 2007, the items used to assess supervisor quality were scaled as there was an adequate sample size (alpha = .74). Those items are represented in table 3 in italics.

Table 3: Supervisor Evaluation

Supervisor questions	N	Mean	SD
Quality of instruction by supervisor: Giving constructive feedback	150	4.62	.58
Quality of instruction by supervisor: They are helpful and knowledgeable in the subject/department you are working	58	4.72	.45
Quality of instruction by supervisor: Professionalism	58	4.78	.42
Supervisors are effective in passing on their knowledge to me	*92*	*4.63*	*.71*
Supervisors are accessible to me when I need assistance	*90*	*4.51*	*.75*
Supervisors support me in my learning	*91*	*4.59*	*.75*
Supervisors are clear about their expectations for me	*89*	*4.65*	*.61*
Scale total (reflects items in italics only)*		*4.57*	*.63*

* Alpha =.74

1= poor 2=needs improvement 3=average 4=good 5=excellent

Evaluating the scaled response for supervisor quality, 74% of internships rated the overall quality of their supervisor as "good" or "excellent," with 48% of internships rating the overall quality of their supervisor as "excellent." For the item assessed across all surveys (quality of constructive feedback), 97% of internships rated the quality of feedback as "good" or "excellent."

This positive rating of supervisors was reflected during the focus groups, in which numerous youth, interns and non-interns, spoke highly of the staff's supportiveness and willingness to help, even with topics outside of Youth Radio:

> *Yes, they believe in us. They're letting us say what we have to say, and they're listening and they're letting everybody else listen*
>
> *If we're doing a good job, they're going to make it happen, they can see it happen and they congratulate us*
>
> *And, the adult instructors . . . they take the time to listen to you and with our academic advisors, you don't have to talk about just academics with them. They'll help you with your teenage issues. It's like Youth Radio is kind of a home*

Peer Teacher Evaluation

Peer teachers are an important part of the Youth Radio program. In all, the Core and Bridge students report that they have had a good to excellent experience with their peer teachers. For example, 76% of the Core students rated their peer teachers as exhibiting a high level of professionalism and reported that the peer teachers are very supportive of their learning. Almost all Core students (92%) reported that the peer teachers were generally knowledgeable, as well as being knowledgeable about radio recording, music and studio operations. Lastly, peer teachers were rated highly in terms of their accessibility and ability to provide constructive feedback. All Bridge results are very similar those of the Core students, with between 87% and 100% giving peer teachers good to excellent ratings across all categories.

These data were supported by the focus group findings, in which youth explained why they felt they were able to learn better from peer teachers than from adults or Youth Radio staff:

> *It's like it was really mostly the peer teachers talking to us. You didn't have an adult talking down to you all the time. It was like I felt more of a connection of a peer talking to me than some adult.*
>
> *It's good to be taught by someone your own age so they know how it feels when you don't get something right away.*
>
> *It's really good to have peer teachers, and then that's who you look up too, like I want to work here too, I want to do what you're doing.*

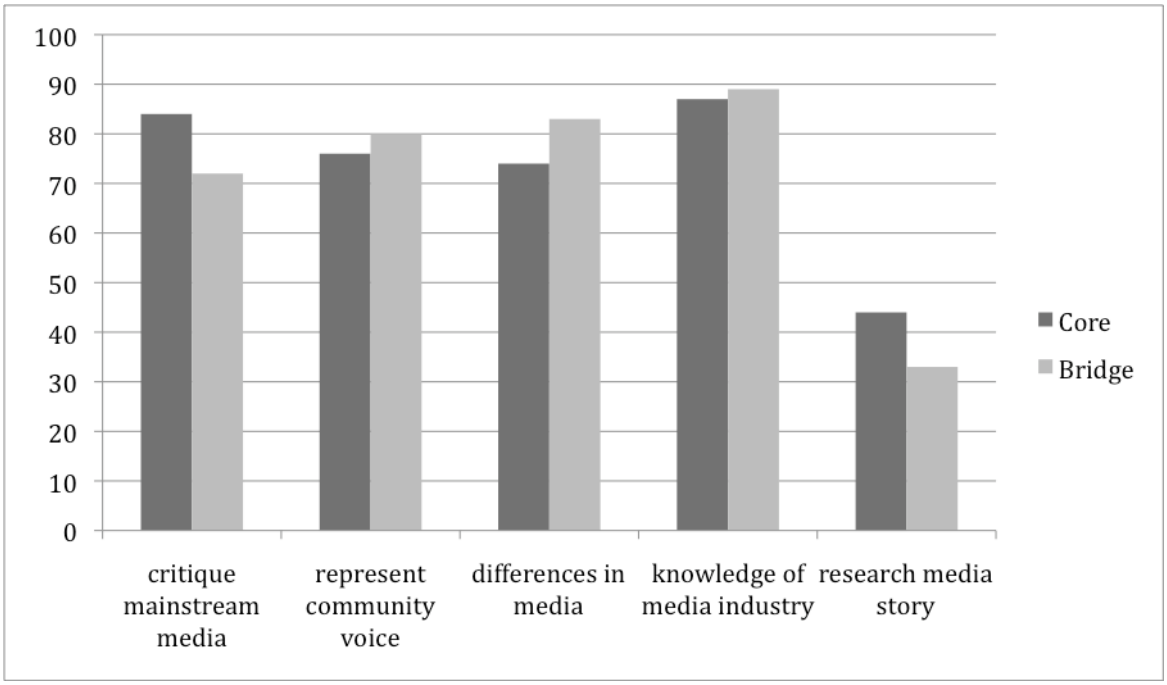
I think all of the adults here, the main teachers or whatever, they sort of talk at you about all of this stuff; and a peer teacher will sit down and they are your age, and they can relate to you, and they can teach you, and you'll probably listen more to them.

Participants felt strongly that their ability and willingness to learn was positively influenced by the presence not just of staff, but of the peer teachers. This willingness was attributed to a greater feeling of ease because of the proximity in ages, their perception of the peer teachers as role models, and the ability to relate to them.

Focus on Media Literacy

A major focus of Youth Radio is providing students with the opportunities to learn about different forms of media, how to discriminate among various sources of media and what careers are available in the media world. Almost three quarters of Core students and two thirds of Bridge students agreed that participating in Youth Radio influenced decisions about the types of media they consume. Most Core students (at least 75%) reported that they learned how to critique mainstream media, represent their community's voice through media, and general knowledge of the media industry that they would have not learned elsewhere, through their experience in Youth Radio (see figure 1).

Figure 1. Percentage Media Literacy Items, Core and Bridge



This sense of empowerment and critical thinking related to the media was strongly reflected in the Core and Bridge focus groups. Youth radio participants describe themselves as active consumers and creators of media, no longer simply passive

observers. In fact, some expressed mild annoyance with not being able to "just watch tv" or "just listen to the radio:"

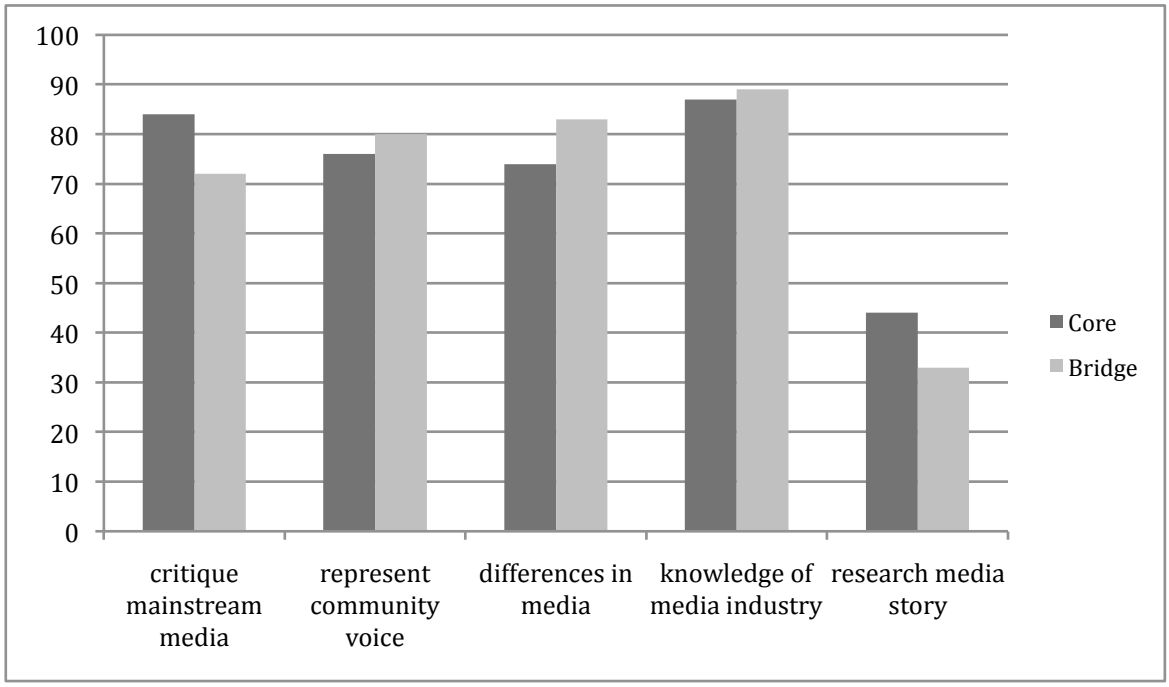
> *Now, when I see stuff, I'm like what are they trying to say and why are they doing that, why are they playing that music for the background. I just like to pick apart and see what they're trying to tell you.*
>
> *I kind of analyze everything I watch. I question why the director did something like why did he do it this instead of that way. The same with music.*
>
> *If I'm watching TV, I'm like they're doing, they're trying to get me think this, they're trying to get me to buy that, or act like this. Basically I'm analyzing. People just watch it, listen to it unconsciously, but me, I break it down.*
>
> *Whenever I see somebody being interviewed on TV, I'm always anticipating the next question because it's like I'm thinking like they talk.*

The experience at Youth Radio seems to have taught them to analyze how information is presented and, in turn, to create their own forms of media that they often believe represent less manipulative, more honest reporting than the mainstream media:

> *If you can actually get in the media like we're doing here, you can actually put out positive things [instead of negative things].*

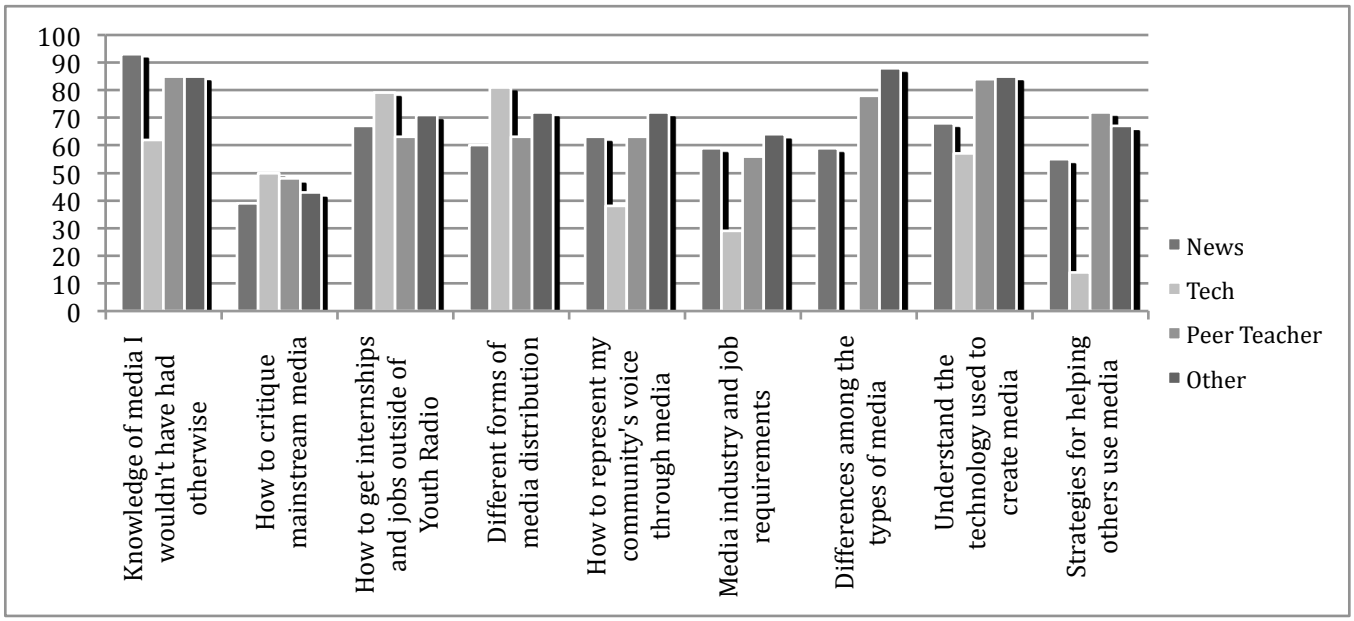
In fact, a vast majority of Core (87%) and Bridge students (93%) agree that they are interested in pursuing a career in the media industry. This percentage was lower for the interns, with 68% of the internships evaluated (N=158) reflect youth responding "yes" or "maybe" to the same question. The lower percentage for intern interest in a career in the media industry may reflect the fact that 46% of youth held more than one internship, thus allowing an individual's score to be counted more than once.

Figure 2. Percentage Media Literacy Items, Core and Bridge



The data for interns were analyzed separately to account for differences in internship as well as length of time in program. Figure 3 shows media literacy categorized into four types of internships: News production (N=48), Technology (N=21), Peer Teacher (N=66) or Other (health, administration, music etc., N=51).

Figure 3. Media Literacy Separated by Internship Type (Percentage)



Evaluation of technology internships, which included web production as well as skills related to the technology, had a greater percentage of youth reporting knowledge of how to find internships and jobs outside of Youth Radio (79%) and knowledge of different forms of media distribution (81%) compared to other internships. Although there was no statistically significant difference using a Chi-square test, the descriptive results show technology internships were rated higher in these practical areas.

In addition to technical skills, technology interns may be exposed to the added benefit of learning to communicate effectively with different audiences. As a technology intern stated:

> *In tech, I feel most of it is interacting between the staff—like production needs, their needs and then also being able to teach people. I think there is a lot more to just like fixing the equipment. A lot of it is figuring out what producers need, what IT can do. It is definitely a communication, strong on communication.*

This view was supported by a statement from a tech supervisor:

> *[The skill they are getting out of being a tech intern] is definitely a communication, strong on communication. They have to relay either teaching methods or they have to negotiate them between what they can do, when they can do it.*

Consistent over all intern surveys was an item assessing students opportunities to learn new technical skills related to new media technologies (N=186, M=4.22, SD=.84), which was based on a five-point scale with 1 = poor and 5 = excellent. To examine the possible relationship between the move to the newer building in Summer 2007 and students' reported opportunities to work with new media technologies, the data were split at the time when the move occurred. An analysis of variance (ANOVA) was conducted and significant differences were found (see table 4). After the move, internships experienced a mean change of .42, nearly half a point increase in agreement.

Table 4. Opportunities to Work with New Media Technologies, Before and After Move, Interns

	N	Mean	SD	F
All interns				F(1,185)=6.67*+
Before move	31	3.87	.957	
After move	155	4.29	.797	

* significant at p=.01 level

Although these results are tenuous given the larger sample size after the move, our analyses did find a significant difference, p=.01.

Overview of STEM Outcomes

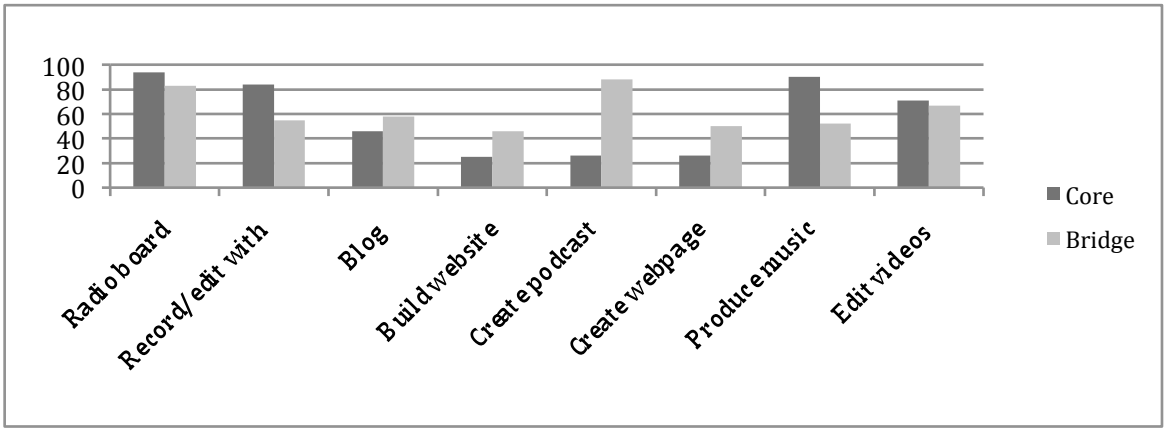
Focus on Technology

Another important goal for Youth Radio is for their students to learn new and exciting technology skills to support the students' future goals. All but ten Core students (out of a response group of 120) reported that they have learned how to use new technology skills through their time with Youth Radio. Similarly, 95% of Bridge students agreed that they had learned to use new technology skills through their program and 86% of internships evaluated had provided the youth opportunity to learn computer software skills specific to their internship. The mastery of those skills did not come easily to many of the youth, but appeared to lead to increased confidence and self-esteem:

> *I was scared [at first to use Pro Tools]. I was like I'm not going to get it right, I can't do it. I became an expert at Pro Tools and now I can edit all of my stuff . . . Technology is everything.*
>
> *50 percent is technology and the other 50 percent is your thought because none of this can work without the proper person working at it.*
>
> *Everything I've done is my best accomplishment. Nothing topples the other because it's stuff I've never done before so I'm proud of everything I do.*

Students were given the opportunity to choose all of the new skills that they had learned with a yes/no response. Of the Core students who had the opportunity to answer these questions, 94% reported that they learned how to operate a radio board; 84% learned how to record and edit using Pro Tools; just under one half learned how to blog; and about one quarter learned how to build a website, podcast page and/or create a webpage layout (see figure 4). Many students are getting a wide variety of technological experiences that they would not get anywhere else.

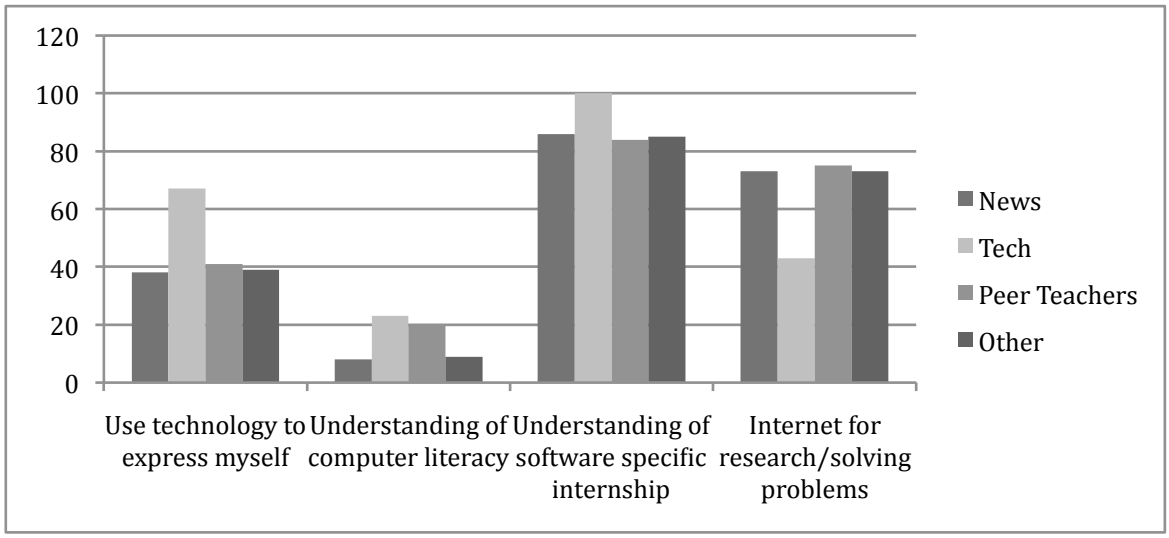
Figure 4. Percentage of Core and Bridge Students Learning Various Technology Skills



Note. Sample sizes vary (between n=48 to 107 for Core students and n=25 to 76 for Bridge students) as only some students had the opportunity to take each survey.

Intern data were again separated by type of internship to better understand the relationship between technology skills and internship experience. While the number of internships varied, overall technology internships represented a smaller sample size (n=7 to 21) than other internships (n= 22 to 66). Figure 5 reflects the four types of internships and four items assessing skills with technology.

Figure 5. Technology Skills Separated by Internship Type (Percentage)



Technology internships reported higher rates of technology related learning in three of the four items assessed. Sixty-seven percent of technology internships (n=21) showed youth being able to use technology to express themselves, compared to between 38% and 41% for News internships (n=48), peer teaching internships (n=66) and other internships (n=51). The only item for which tech internships (n=7) reported a lower use than other interns (n=22 to 33) was in use of the Internet for research and solving problems. While the reported rates of understanding of computer literacy were low across internships, this may reflect that youth already entered Youth Radio computer literate, or perhaps they were unfamiliar with the term "computer literacy." An analysis of their statements made during focus groups showed youth clearly gaining skills and confidence with computers and the technology associated with them:

> *When working web, you've got to understand how information is sent and placed. I just have the sense of knowing how files and images, and audio, are shared and communicated between computers.*
>
> *And as technology keeps moving forward, you have to constantly keep learning new programs and keep up with everyone because if you don't, then you become obsolete and there's no reason to have you around.*
>
> *Every time I go on a computer, I can really just look at it and say, man, I know how to make that web page.*

In more than one focus group, the males did the majority of the talking related to technology and computer skills. This may reflect greater confidence with technology or perhaps with the format of the focus group; further evaluations can explore a possible relationship between confidence with technology and gender. Nevertheless, one female in the Tech Intern focus group explained her decision to focus on computer science in college:

> *You come to work with it and you ask yourself that question is this what I want to do? Can I handle doing this every day? Can I handle studying this? And pretty much my answer was yes. So I am definitely focusing on computer science.*

Focus on Science

For Core and Bridge students, in order to better understand the possible relationship between introducing science -related curriculum, we split the data at the time point when the Brains and Beakers curriculum was added to Youth Radio in Summer 2008 for Core students and Winter 2009 for Bridge students. Below are the results from comparing the students' outcomes between these two time points.

The Youth Radio program wanted to expose their students to science in a variety of ways and contexts in order to make it clear that science is all around them and can be identified. Over half of Core students responded that they had good to excellent training in environmental health and justice (60%) as well as community health (69%). Just under half of Core students (48%) felt that the Youth Radio training gave them a better understanding of the role of science in everyday life. Lastly, a majority of Core students (71%) reported that they were given opportunities to think differently about science (see table 5 for means and standard deviations).

Table 5. Descriptive Data for Science Items, Core

Item (Maximum score=5)	N	Mean	SD
Opportunities to think about science differently	122	3.87	1.21
Environmental health and justice	122	3.77	0.93
Community health	121	3.93	0.95
Understanding science in daily life	62	3.50	1.00

To determine the relationship between the students' responses to the science items and the introduction of Brains and Beakers, we performed an analysis of variance on a single item regarding the opportunities provided by Youth Radio for students to think about science differently. For both Core and Bridge students, there was a significant difference before and after Brains and Beakers. Because the science item was asked later in the program, there was a smaller sample size for both programs. Specifically for Core students, the average rating was near "needs improvement" or "average" (M=2.77, SD=1.42) before Brains and Beakers. However, the ratings were much higher after Brains and Beakers (M=4.31, SD=.78), producing a significant difference, $F(1, 44)=21.92$, $p<.05$

(see table 6). That is, students began to rate Youth Radio higher on providing more opportunities to see science in a different way after the implementation of the new curriculum, Brains and Beakers.

Table 6. Thinking about Science Differently Before and After Brains and Beakers Curriculum, Core and Bridge

	N	Mean	SD	F
Core				F(1,44)=21.92*+
Before BB	13	2.77	1.42	
After BB	32	4.31	0.78	
Bridge				F(1,17)=11.10*+
Before BB	7	2.86	1.35	
After BB	11	4.55	0.82	

* significant at p<.05 level
+ low sample size, results tenuous

All told, the quantitative analyses and focus groups suggest that youth perceived the program favorably and gained considerable technical and professional expertise through their participation. Ratings for overall program satisfaction were high (at least 4.5 on a 5 point scale), a point that was reinforced in the focus group comments about media literacy and technical skill acquisition. There were some trends suggesting that the move to the new building and introduction of Brains and Beakers improved students' opportunities to work with cutting-edge technology and their awareness of the role of science in daily life. The small sample size limited the ability to see statistically significant differences.

Case Study Analyses

The rest of the results section contains case studies of key program initiatives:

- The move to a new, digitally-advanced building
- STEM news reporting
- Science programming in the Core curriculum
- Community partnerships

Each case study is a narrative of the development of the featured initiative and its effects on various grant participants (e.g., staff, external partners, students). Collectively, the narratives describe Youth Radio staff members' efforts to integrate STEM activities into their existing programming, including the ways in which they leveraged existing resources and took advantage of new opportunities to implement their ideas. The cases also

describe the emerging changes in staff and students' attitudes toward STEM and expansions in partnering organizations' views of youth media.

Case 1: New Building, New Opportunities

The technology and engineering components of STEM were easily integrated into the Youth Radio curriculum, which "is deeply infused with technology" (Lissa Soep, Youth Radio Education Director). As part of the Digital Technology Institute funded by the grant, Youth Radio students worked with a variety of hardware and software tools as they produced radio programming, original music and news stories. The organization's move into a digitally advanced building in Spring 2007 allowed Youth Radio to bring both its curriculum and media production and distribution activities into the 21st Century. As a result, the young people were able to work with and develop skills using cutting-edge digital technologies. This case examines the opportunities created by the new building and subsequent enhancements to the technology curriculum throughout Youth Radio, with a particular emphasis on the evolution of the Tech interns program.

1701 Broadway. Youth Radio's new, state-of-the-art media production and distribution facility, located at 1701 Broadway in Oakland, CA, gave the students entirely new levels of hands-on experience with the technology and production equipment. According to Director of Youth Programs Erik Sakamoto:

> *Even if we had all of the new equipment in that [old] facility we wouldn't have been able to have young folks interacting with it in the way that they are now. There wasn't enough space. There wasn't enough breathing room. Here the majority of the time a young person is using a piece of equipment for an extended period of time by himself and that's huge. … So there is that sort of creative freedom that comes with having the equipment. Then obviously it helps a lot in terms of being able to teach because they are hands on. … So everything being new and pretty much ahead of the curve in terms of what other studios are out here or definitely what other youth organizations that are teaching media are out here.*

To showcase the wide variety of technology and digital media production learning opportunities provided for students in this new building, Youth Radio produced a video entitled *Storefront to Forefront: Youth Radio Finds a High-Tech Home in Downtown Oakland*, which can be viewed at http://www.youtube.com/watch?v=cy3YMjzwZTc. The video offers a glimpse into the high-tech world of master control, sound studios, Web site development, and digital media production the students discuss throughout this report and engaged with on a daily basis.

The technology embedded in the new building also allowed Youth Radio to take advantage of advances in digital media distribution, namely reaching audiences with Web content. Students learned not only to produce a live radio show but also how to package their programs as podcasts for the Web. Students had to think about what it meant to have an *on demand* audience:

So they are interacting with our website content management system so they're tooling around in Druple at a very early stage and putting up their stories. Their stories, their commentaries, the roundtable discussion that's on the Friday night show and they're getting up there that evening and then it's on our site. (Erik Sakamoto, Director of Youth Programs)

Newsroom interns took this process a step further, learning how to analyze Web metrics and how to use this data to inform their story creation and distribution. As an unintended consequence of this new technology, these students have been exposed to statistics and data analysis.

Overall, the new building provided students with new opportunities to work with digital technologies and to learn how those technologies are changing the way media organizations create and distribute their content. Youth Radio also used the move to the new building to create a new internship area focused on technology and engineering.

Tech Internship

In the new building, Youth Radio created a Tech internship in which students worked with staff engineers to set up and maintain the technology in the building. This internship has had two distinct phases:

The older group went through a program where we had a real emphasis on infrastructure in the technical sense like having them up in our master control, building out studio stuff. Now that everything is functioning and it is pretty much running we are doing more maintenance stuff and putting tech people into individual departments. (Technology staff member)

To get a picture of this internship and the effects it had on the student interns, REA interviewed the Tech staff and conducted a focus group with a set of former and current Tech interns.

Tech Internship 1.0. In the beginning, student Tech interns wired the new building, set up sound studios, built the computer server system, soldered and built panels and computers, routed and replaced cables for computers and media equipment, and dealt with computer hardware and software problems. Essentially, these interns worked alongside the staff as a functioning IT department:

I remember when I was a Tech intern here. It was sort of hectic, because we just moved to this brand new building, some things were working, some things weren't, so pretty much anything that wasn't working, people would call up the Tech Department, can you fix this, can you fix this? Also, we'd be running around all over the building, third floor, basement, everywhere. (Tech intern)

These students worked primarily with Technical Director Tim McGovern, who they referred to as a mentor:

If you wanted to participate and try it yourself, he'd allow you to. If you didn't think you were ready in something, weren't confident, he'd teach you, he'd show us hands on what to do, and when problems

would actually happen, it wasn't necessarily he'd force us to go do it ourselves, but eventually as we got better, we'd go do the things ourselves, but I guess we just sort of learned from what he did, watched him, observed and monkey see, monkey do. There you go. (Tech intern)

Tech Internship 2.0. Once the new building was up and running, the nature of the Tech internship program changed. The apprenticeship model continued in the second phase:

All I do is I follow Shawn. He's a tech guy here. I tell him the problems, the news, the wiring, and I just follow him and I assist him with some of the skills I learned from being a tech. (Tech intern)

However, the work changed to become more specialized and project-based. Interns were assigned to a specific area, such as sound engineering in the studio, that is, running the board and managing audio levels.

At the same time, the Tech staff stressed that students learned more than tech skills. Communication is a central component of their jobs:

In Tech, I feel most of it is interacting between the staff, like production needs, their needs and then also being able to teach people. I think there is a lot more to just like fixing the equipment. A lot of it is figuring out what producers need, what IT can do. It is definitely a communication, strong on communication. They have to relay either teaching methods or they have to negotiate them between what they can do, when they can do it. I feel a lot of it is that they have to go talk to the newsroom and be like we can't do this today or right now we need to. A lot of it is people skills.

One of the students also brought up this skill: "I was a tech teacher, so being able to communicate things to people in a way that they can understand it."

While Youth Radio works to develop self-confidence in all of the students by encouraging them to find their voices and produce high-quality media, both the staff and students commented on the unique confidence students gained as Tech interns. This internship allowed them – literally – to peel back the covers on the equipment and technology they used to create media:

I do feel like the people in tech know part of the building and how everything works compared to most of the students who are at a place where they are users. They come to our students to find out how do I do this? I think my interns, all of them, have a certain sense of pride of being able to know how to go the ins and outs of upstairs and downstairs comparatively. To most people it is just overwhelming. I feel like that part of it getting broken down gives them a sense of empowerment and whatever tech knowledge. (Tech staff member)

Really I find with the Tech interns we have right now to give them a project and have them be able to go do it and come back and be like, 'I did it!' is pretty amazing. (Tech Staff member)

Sometimes I'd have to go upstairs to the web rooms and help somebody out that didn't know what they were doing or had messed up their computer somehow. It was usually a simple fix that they probably didn't know. (Tech intern)

I know how to do a lot of stuff with equipment now. Almost every type of electronic gear, I kind of pretty much know the basics of it and what may or may not go wrong with it, so I guess that's something I

pulled off of it. You could call it real good trouble shooting skills I guess. For instance: When something is wrong with something, say like your recorder, for some reason it says you're recording but you're not getting any feed into it, I learned a lot of ways to figure out what's wrong with it and how to fix it, find a solution. (Tech intern)

Influence on careers. The students' experiences as Tech interns clearly influenced their career choices and aspirations. Most of the students who participated in the focus group, which included an even mix of young men and women, were majoring in technical fields, such as: mechanical engineering, electrical engineering with a minor in computer engineering, and computer science. Students not yet in college were looking at technical careers, as well. One wants to go to Cal-Poly San Louis Obispo because *"that's the highest rated engineering college in California."*

Some of these students developed an interest in these fields during their internships; others used the internship to try out a technical career:

One thing that definitely sparked that interest was working as a Tech intern here…you come to work with it, you ask yourself that question. Is this what I want to do? Can I handle doing this every day? Can I handle studying this? Pretty much my answer was yes. So, I'm definitely focusing on computer science. (Tech intern)

A couple of the students do not plan careers in technology, but they were still influenced by their experiences at Youth Radio. While one former Tech intern was majoring in Psychology to be able to continue working with and helping young people, another wants to be involved in entertainment/media/radio:

What I got out of here was basically a goal. …when I joined Youth Radio I realized that what I like to do, I like to talk on the radio. I like to DJ, so one of the things, now I'm working towards working at a radio station, and all that type of stuff. (Tech intern)

This experience as working tech specialists also shed light on one not-so-positive aspect of the job – isolation, especially for the students who were assigned as the sole tech engineer working on a project:

I think Tech Department, there were moments where it would be a job where you would have a lot of person to person contact, and there were times where you would go a week and you'd just sit in the basement and do your own thing. (Tech intern)

Internship sustainability. While the Tech staff crafted a curriculum to ensure that students learned a variety of technical and engineering skills, the teaching model employed was one of apprenticeship. There were no instructional staff members assigned to the Tech interns, and this factor remains a concern. Youth Radio would like to hire a staff member to teach and work with the interns (as opposed to relying on the Tech staff whose job it is to keep the building running). Lack of staff to supervise also restricts the number of Tech interns they can have at any given time. Students agreed that this addition would be valuable:

One thing, I wish there was more tech interns. It's a valuable skill to know, because all the stuff you learn here, fixing computers, phone lines, stuff like that, you're going to need that at home, and its better to learn it, do it yourself than to pay somebody to come fix it for you. (Tech intern)

Partnership with David Pescovitz

The opportunities presented by the move to the new building also led to one of Youth Radio's most fruitful partnerships in science and technology. When Youth Radio staff decided to redesign their website to take advantage of the new digital media and Web 2.0 capabilities, they invited David Pescovitz, Co-Editor of the Boing Boing.net blog, to come talk to both staff and students. According to Education Director Lissa Soep, "BoingBoing had figured out some way to grow this humungous audience and this profoundly engaged audience around the content that they were putting out." The staff hoped to learn from this experience. They did, but they also got much more.

In addition to his role at Boing Boing.net, Mr. Peskovitz is a professional technology journalist, Editor-At-Large for *Make* magazine and regular contributor to *Wired* magazine. Impressed with the students, the resources, and the organization, Mr. Pescovitz came away from his first visit with a desire to continue his involvement with Youth Radio:

I really felt a great sort of energy there. I liked the fact that it was a Friday evening and it was buzzing with students who you would expect would be out doing something different on a Friday evening rather than hanging out there and talking to some geeky science tech guy. But they were totally enthused and that got me really enthused and then they gave me a tour and it just really felt like part of my work is looking at the future of media and how media may evolve in grassroots media and do it yourself media and how new technology is enabling people who normally don't have a voice to be able to tell their own stories and distribute those stories. For me Youth Radio like a light went off in my head that this embodies all the kinds of things that I'm forecasting and that I think are important and interesting to me.

Over the next months, Mr. Pescovitz called on his relationships with inventors and scientists to organize a series of STEM journalism events for Core students dubbed Brains & Beakers. He also connected Youth Radio to Dale Dougherty, Editor and Publisher of *Make* magazine and founder of Maker Faire, an annual event that brings together inventors, scientists and crafters to showcase their do-it-yourself (DIY) activities and creations.

Mixing Maker Faire. To identify what role Youth Radio could play in Maker Faire, Mr. Pescovitz brought Mr. Dougherty to meet with Youth Radio staff. They decided that a team from Youth Radio would create a soundscape of the event, collected and produced live on-site. Creating this soundscape required multiple steps:

1. Field producers roamed the fairgrounds, gathering ambient sounds on flash recorders and returned with them to the Youth Radio booth;
2. At the booth, audio engineers imported the recordings and edited them down to usable beats and sound bites using music software; and

3. Music producers mixed the ambient sounds into an ever-evolving audio collage.

The staff made the potentially risky decision to have students conduct this live demonstration. Moreover, it turned out that none of the technical staff could attend the event. The staff members supervising the students at the event would not be able to assist with any technical difficulties that might arise during this "*technically incredibly complex"* production (Education Director Lissa Soep). Confident in their students' technical skills, the staff spent two sessions training a group of Peer Teacher interns from the music production program to create the soundscape.

Mixing Maker Faire turned out to be a successful event for a number of reasons. The participating youths expressed a great deal of enthusiasm for the opportunity to showcase their skills to a live, engaged audience. Located at the entrance to the Expo Hall, one of the events largest venues, Youth Radio had a captive audience of people in line to purchase food. High visibility coupled with the nature of Maker Faire, which supports interaction between "Makers" and visitors, meant that the interns were able to share their work with an appreciative public. Furthermore, the students felt that Maker Faire offered no shortage of interesting sounds to sample, ranging from the crowds to mechanical noises emitting from various creations on display.

This demonstration was well received by both Maker Faire attendees and organizers. Perhaps more importantly, though, it signified an expansion of Youth Radio's involvement in the world of science and technology – from journalists to participants:

> *I remember when I went last year, I went outside of Youth Radio and I was like wow this would be a really cool thing for Youth Radio to cover. Then in less than a year's time not only were we covering it but we were actually being showcased there with our own booth and doing something really innovative.* (Education Director Lissa Soep)

For Ms. Soep, the best part of this event was that it was handed over to the students:

> *Those are the best moments, when the young people actually do know more than you do about technology. You're not just sitting back and letting them grow under your mentorship. You are actually are dependent on them.*

The attitude and approach taken with Maker Faire reflects a theme evidenced throughout this case study, that is, student involvement and responsibility at every level – in their building and with their productions. Through this approach, the students gain invaluable technical skills and real-world job training:

> *There's so much to web interning, it's like I'm learning how to run the web site, and I'm even adding stuff to the web site. My supervisor, which is my mentor, he basically runs the whole web site. Basically, I'll learn how to run a website.* (Tech intern)

During the Tech internships, these students learn how to operate and repair the hardware and software that keeps Youth Radio online and on the air. This same level of professional experience and responsibility carries through to the media production training, as well. Case 2 turns to the production of STEM stories by Youth Radio journalism students.

Case 2: STEM Reporting at Youth Radio

Youth Radio had always covered some stories with a science or tech focus, particularly in the L.A. Bureau. As part of the grant, they planned to expand their science and technology reporting through the Newsroom's science desk beat, overseen by a staff member with science journalism experience.

Over the past three years, the staff has refined its vision of what constitutes a Youth Radio STEM story by considering: What sorts of topics would youth want to cover? What perspective would they bring to a topic? How could youths create stories that expressed their unique voice while also being attractive to outlets like NPR? Education Director Lissa Soep explained how the story content changed from what she had originally expected:

> *I think we couldn't have anticipated in some ways the way that transformation of the digital culture has brought us so many news stories for us around the culture of technology and how it is affecting young people's lives and opportunities in communities and also I think just environment with the green kind of movement becoming something that's really penetrated the youth community.*

The addition of science journalist Charlie Foster as the new Science Producer expanded Youth Radio's ability to create a professional science journalism experience for the young people. Ms. Soep observed, "*I think that's one of the things that comes up in our science reporting in general is the young people really want to be able to do real science journalism and not just first person essays. Having Charlie here has allowed us to have a stronger kind of repertoire for doing that because of his background in science and as a science journalist."*

At the same time, Mr. Foster also had to learn what his role would be and what science journalism at Youth Radio would look like. While Mr. Foster expected that he would pitch story ideas to the interns, he learned that story ideas more often than not came from youth experiences and interests:

> *Story idea generation is really becoming a lot more from them than I thought it would. Even in instances where I find the story it's taken into a direction through them. … questions that I wouldn't have thought to ask that took the story in a direction. … It was something that the more I sort of let it happen organically the better it turned out.*

As a freelance science reporter, Mr. Foster was able to teach the students to consider which outlets might be interested in a particular story. Still, that was often a secondary consideration that came after topic selection:

You find a science story and you either figure out how to come at it at an angle that sort of gives it a youth voice that would be attractive to an outlet like NPR…or you find a young person and ask them what kind of science story or technology story would they be interested in doing and have them generate an idea just out of what's going on in their life and either using it with science or pointing them in the direction of a particular outlet that would be interested in it.

Youths were particularly attracted to applied science, which was a different from Mr. Foster's usual take on science journalism:

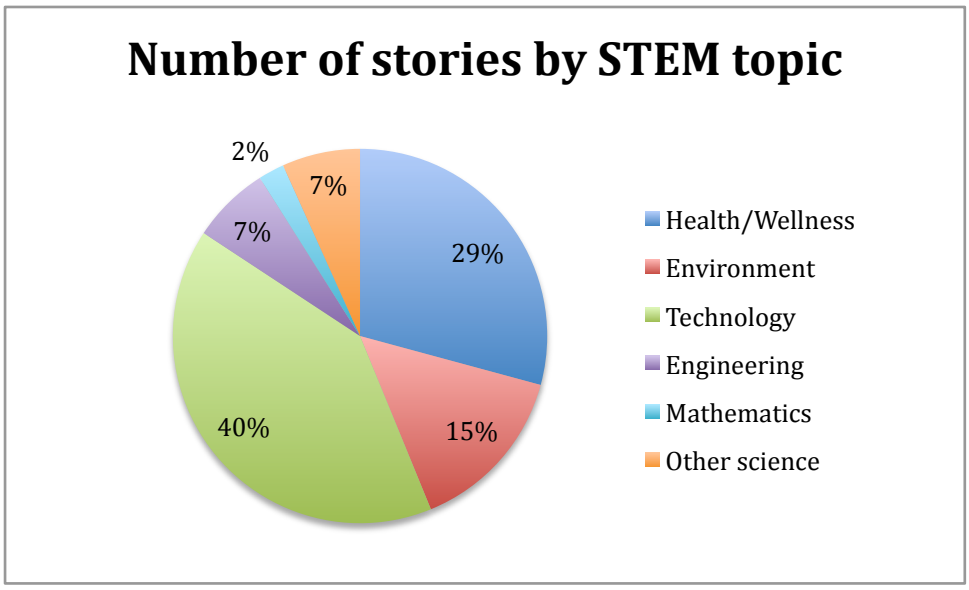
I came in here with an assumption of what a science story was and they are sort of changing in a way that it's much more it's really the hands on every day kind of science and not just reporting on what happened in Iraq…or even from a press release of Silicon Valley…. It's really how we use science in our every day experience and starting from there.

Content Analysis of STEM Stories

An analysis of the STEM stories bears out Foster's observation that youths were attracted to applied science topics. To provide an objective examination of the content and quality of the STEM stories produced by the youths, evaluators analyzed all radio pieces about STEM produced during the grant period (July 2006 – July 2009). The stories were first coded for general content area and then a subset were analyzed on a number of criteria based on (1) general radio journalism practices, (2) science journalism practices, and (3) Youth Radio's approach to stories.

A majority of the 89 pieces were brief commentaries; others were longer feature stories, such as those that air on NPR. As figure 6 shows, stories generally covered applied sciences, such as health and the environment, but the most popular category was technology (40%). While some of these STEM pieces were completed as part of the curriculum, most were simply topics chosen by the students. The pieces came from all bureaus.

Figure 6. Content of STEM Pieces.



Regardless of the topic, all stories were expected to meet certain standards. According to the staff, Youth Radio stories are expected to meet certain standards before distribution, such as: relevance to young people, a youth perspective or insight, and accuracy in all facts and information. Commentaries generally emphasize the student's perspective or opinion. In contrast, all feature stories must be fair and balanced.

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Reviewers randomly selected a sample (N=25) of the stories for a more in-depth review of their content and writing quality. Evaluators wanted to examine how the stories met standard expectations for a news story, as well as how well they communicated youth voice. Table 7 shows the categories with a brief description of each. Stories were rated on a four-point scale.

Table 7. Ratings of STEM Pieces

Category	Definition	N	Mean	Standard Deviation
Quality of writing				
Hook	The author introduces the piece in a manner that grabs the listener's attention and introduces the piece's main idea.	25	3.63	0.58
Elaboration	The student provides examples and explanations of the information provided. Any jargon or slang terms are fully explained. No unanswered questions are left in the listener's mind.	24	3.63	0.71
Conclusion	The student sums up the main idea in the piece without just ending it abruptly, introducing a new idea or going off topic. The listener is left satisfied that the piece is complete.	24	3.46	0.93
Characteristics of content				
Science, technology, engineering, math content	STEM is the main driving force behind the piece.	24	3.79	0.51
Youth perspective	Did the reporter cover a story that might have also been covered by an adult reporter in a new way?	19	3.63	0.68
Connection to community	The student has covered a topic that very clearly connects to the community	24	2.79	1.47

Scale: 1 = Story does not have the required elements; 4 = Story has hit the bull's-eye and reached the mastery level.
Note: Ns do not always equal 25 in cases where the rater was unable to rate a story on a particular criterion.

Overall, the pieces received high marks for writing (Means ranged from 3.46/4 to 3.63, SD = 0.58 to 0.93) and youth perspective (M = 3.63, SD = 0.68), and STEM topics were the central focus (M=3.79). Stories often had a connection to the local community. The mean rating on community connections was lower than the rating for writing and youth perspective because not all stories were intended to have a community focus.

Stories generally included facts and research and connected the STEM topic to the young people's lives. Many stories dealt with addictions – to smoking, coffee, prescription painkillers, and even MySpace. They often included a personal angle, such as the student who talked about her mother's devotion to cooking with fresh food or another who explained why racist comments in online games do not discourage him from playing. In a

commentary about traditional medicinal herbs, one young man discussed both his family's Mexican roots as well as a way for people without health insurance to access medicine.

Addressing a primary goal of Youth Radio, these pieces considered STEM issues from a teen's perspective. For instance, one commentary on global warming argued that green campaigns often involved buying expensive products, such as hybrid vehicles; thus, these efforts were not engaging young people, especially in lower-income areas. A piece on social networking argued that the 25 and under set view privacy differently than their older peers. In fact, youths see public messages on social networking sites as more private than a more publicly accessible medium like radio.

Creating a STEM Story

While the content analysis provides an objective measure of the quality of the students' STEM pieces, it does not allow examination of the process of STEM story development or what students might learn during that process. Evaluators therefore chose to take a closer look at the development of a STEM story.

The story "Cash-Strapped Schools Rear Lab Animals," a two-minute radio report that aired on NPR, describes efforts in the Oakland Unified School District to maintain its hands-on elementary science program in light of extreme budget shortfalls. The district has begun to raise its own live organisms and now has an array of crayfish, meal worms, aquatic snails and other creatures in its warehouse.

The piece begins with a scene from a third grade classroom, where a team of children is observing a pair of crayfish. The reporter says the children's "favorite subject is crayfish mortality" and segues into a clip of a student describing how she and her classmates found two dried-out crayfish outside of their tanks. He asks the girl if she thinks science is fun; she says, "Yeah." The reporter says, "But that fun is expensive" and transitions into quoting the cost of animals in a typical hands-on program and the district's efforts to reduce that cost by 90%. He interviews the District Science Administrator and describes the "modest zoo" that has emerged in the warehouse where the district assembles its hands-on science materials. He gives a rationale for why the district would go to such lengths to maintain its hands-on program (children remember more when they do activities than when they read about them) and uses clips from an interview with a University of California, Berkeley education professor to address one of the consequences of such behavior (more time raising animals means less time spent on instruction). The reporter concludes:

> *But science educators like Caleb Cheung know that if instruction is left to text books, fewer schools kids will ever know the drama that unfolds through hands-on study of living organisms…and dying ones too.*

This piece on lab animals exemplifies the trends shown in the previous story analysis. It follows the conventions of good journalism; that is, it captures the audience's attention

with a compelling hook, uses examples and explanations to support claims, and ends by reiterating the need for hands-on science instruction. The story has a distinct local connection, and its humor about crayfish mortality provides a youthful spin on the content.

This story also highlights the development of a STEM story in the Youth Radio Newsroom. The piece was a collaborative effort between the youth intern reporter and staff. Science Producer Charlie Foster pitched the idea to the youth reporter, who chose to pursue it because he felt a personal connection:

> *He [Foster] came up to me and he said, "Well, listen we have got this warehouse with a bunch of organisms for a school. Does that sound cool?" And I said, "Yes, that actually sounds really interesting." He said, "And it is for the science program." The really interesting thing was he knows that I am an avid proponent of hands on science because I did not really get much of a hands-on science program through normal school but the rest of the curricular I did. So I loved science outside of school and hated it in school. So I said, "Well definitely. I would love to do something involving that."*

Researching the story gave the intern a new perspective on science education, and how different it could be from his school experience:

> *I really learned just how effective the whole hands-on thing in school is. One of the things, when I went to go visit the school and we interviewed the kids they actually knew quite a bit about crayfish and it was kind of interesting. I wish I had a program like that when I was in school. And they really enjoyed it, definitely. Also I had no idea how expensive it was to put on like hands-on science at school. That is quite a lot of money, but there are ways around that, as I found out also.*

The intern collected interview footage from a number of sources: third graders, their teacher, the district science administrator and a university professor. Preparation varied from audience to audience. With the third graders, he intentionally did no preparation: "If you just try and keep them with a structure they will go crazy and do something else. If you just say, 'Hey what do you like to do?' They will go insane and you will get something out of it." Mr. Foster described how the intern's flexibility led him to capture some spontaneous student moments:

> *The thing about when you're doing radio you're like creating scenes, right, and capturing scenes. So the fact that he was there and coming up with the questions and sort of being in the moment when we went to the classroom with the school kids it just really made it his story. He has this girl talking about how she likes or telling a story about crayfish and then at the end of her story she's just like, [reporter] immediately asks, "So do you think science is exciting?" and puts the mic back on her, and she says, "yeah." And it's a moment that like you can't script and you can't prepare for. It's just like his instinct to do that that really created a scene that ultimately made the story more powerful.*

The interview with the science administrator required more thought about the possible emphases for the piece:

> *We prepared a few questions and we kind of researched it a little bit to see more what it is about and what kind of angle we could take with the story maybe. And so the beginning we knew it was going to be more of a money saving thing in a recession. But at the same time we are the science desk so of*

course we have to really go into the hands on science program. That is what we are here. So we have that in mind also. (Science Producer Charlie Foster)

The direction of the piece took further shape during the editing process. The youth reporter first listened to the interviews to identify central themes. This took a considerable amount of time. The intern explained: *"I spent probably 5 or 6 hours just listening to Caleb, 5 or 6 hours over and over again. Just writing stuff out, trying to think like what can I take from this? And that was really difficult."* A skeleton outline became fleshed out with quotations and accompanying text: *"we picked quotes from all of the people and just pooled them in a massive thing and threw quotes in there and just backed them up with words."*

The story was refined through multiple edits and conversations between the reporter, Youth Radio staff and an editor at National Public Radio. The focus of the piece shifted back and forth between hands-on learning and education policy. The intern commented:

Yes, actually initially the angle of the script inadvertently became like almost solely focused on hands on learning and almost nothing focused on cost cutting. So we switched that around a bit so we still had emphasis on the hands on learning but not so much that there was nothing about cost cutting.

Ms. Soep described a point in the editing where the focus shifted to policy and she encouraged the reporter to retain more of the youth voice:

One of the things that struck me and I was just coming at the later stages of just editing the script that I got the sense that [the reporter] got really interested in the science and also the science policy of it to the point that in an earlier version of the script that I saw was like I was pushing for more of a youth voice. I was like well what about can we hear more from the kids or can you lead with the students in the class at least so that it really has that kind of Youth Radio feel. We figured a way to do that in restructuring the piece but what I think is really important is out of respect for [the reporter] and the fact that he took it seriously the hardcore issues in science education that that story explored that we wouldn't want to turn it into just this light first person narrative kind of piece.

The final piece came together in a way that satisfied the reporter: "I really like it, yes. It is a nice story. And I am really excited that it is on NPR. That is quite an opportunity for someone my age, really for anybody." The reporter's summary of what he hoped listeners would take from the piece is consistent not only with this particular piece, but with Youth Radio's goal of helping youth see science - like media - as a creative act:

I hope that people realize that it is very doable to have hands on science if you can be creative with it. And that's the whole idea of hands on science, to be creative. And I think people when they think of hands on science generally think like oh that takes a lot of materials. It takes a lot of work. It takes a lot of effort and money and all of these other things but not necessarily so much money. It definitely takes a lot of materials but it is very sustainable and it is quite effective.

Before Youth Radio students become science desk interns like this one, they must complete Core and Bridge training classes. Thus, the organization also used the NSF

grant to expose students to STEM reporting from the beginning. Case 3 examines these efforts.

Case 3: Brains & Beakers

One of the Youth Radio staff's goals for its Science and Technology Program was to explicitly address STEM themes in its Core curriculum. The staff wanted to get the youth more invested in science and to see it as something that was relevant to their lives … especially because these youth had been typically *"kind of marginalized from science and math and the way that it's taught in the classroom"* (Lissa Soep, Education Director). An initial partnership with a professional science journalist failed to shift most students' negative impressions about science. Breaking barriers to science learning required appealing to some of the teenagers' core interests … music, technology and controlled explosions. A serendipitous association with a local technology company led to a new series of activities called Brains and Beakers in which scientists and engineers gave hands-on demonstrations of their research to the Core students who would then produce a story. Brains and Beakers not only shifted students' attitudes toward science, but also challenged the presenters' stereotypes about the capabilities of youth journalists. This case will track the evolution of Core science programming and speculate on the factors that led to the most successful activities.

Science Journalism Workshops

Youth Radio's media production staff members are not experts in science journalism. Thus, the program adopted the approach of supplementing their staff by inviting outside experts in the field to conduct training workshops with the students. In Fall 2008, professional science journalist Sally Lehrman conducted workshops with Core and Bridge students on science journalism. Data on these workshops were collected through an interview with Ms. Lehrman, workshop observations, and focus groups with students.

In the week-long Core workshop, Ms. Lehrman began by introducing students to basic concepts of science:

- What is science?
- Why does it matter?
- How does it connect to their everyday lives and things around them?

Then, students were asked to brainstorm ideas for science stories, thinking about what questions they wanted answered and what would help their communities. They came up with dozens of responses, including:

- What is artificial chicken made of?
- Veggie burgers – how do they make those?
- Why does aluminum explode in the microwave?
- How are genetically-modified foods made?
- Do cell phones lower your sperm count?
- Better building structures – how can they hold up against earthquakes?
- Environmentally-friendly transportation – is everything going to switch to hybrids?

The goals of the second session were:

- To have students recognize that science is in life/all around them
- To introduce the basics of storytelling/commentary writing
    - Need facts and credible sources
    - Include personal connection/story to draw listeners in
- How do you do and report on science?
    - Science is not opinion, but you can have an opinion about science
    - Science matters
    - You can't make up facts

Then, each student chose a science commentary topic and began to work with Ms. Lehrman on how to shape the commentary and how to find appropriate research materials. In the final workshop session, students completed their commentaries and read them on the air.

For the Bridge class, Ms. Lehrman organized a group interview/press conference in which the students acted as the press corps on the topic of sex education in schools.

According to Bridge instructor Mike Manuel:

> *The students interviewed [a researcher] for the Public Health Institute Center for Research on Adolescence Health & Development. It was about a 45 minute interview, and we have audio of this. It was more a press conference style interview where 6 students asked her questions about research and teachings on sexual education. They also started on scripts near the end of the session. They learned how to write a lead to a story, grab clips from the interview, and rip what [the researcher] said for their scripts.*

Perceptions of science. Students participated in focus groups to gauge their reactions to these workshops. Two main themes emerged. On the one hand, most students got the message that science was more than what they did in chemistry or biology class, that it was all around them:

> *One time, she had us downstairs while we were eating pizza. And she had this big old board of papers, and we just started blurting out anything we could think of, and she would tell us how it connected to science. The list went on for like 5 pages. It was cool.*
>
> *I think beforehand, I used to think of science as…I would have had flashbacks to middle school where we had to do these 3 page reports with hypothesis and thesis and all these crazy things that you just hated doing. You had to diagnose a bunch of molecules. I didn't think that what you eat every day or people driving around would have that much to do with science.*

On the other hand, the workshop approach failed to connect with a broad audience. Students who said they enjoyed science in school did appreciate learning about it at Youth Radio:

> *When Sally was here, I had fun because I'm in health academy at my school, so when you talk about science, I get all excited because science is something I've always liked to do since I was a kid.*

Many students, however, did not think of science in the most positive terms, and the workshop did not necessarily change that view:

> *When kids hear the word science, they don't light up. Honestly, Sally's approach was not bad. I think the message she was trying to convey was good. I remember it. She was trying to say that everything is science [others agree]. When we were trying to come up with topics, she was saying that you can basically write about anything because anything is about science.*
>
> *Science is not boring…science in that aspect wasn't boring, but regular science is boring.*
>
> *I just don't think science is that fun. We picture it like a cold laboratory room, some old 1970's sinks, rubber gloves, goggles. I think of hard work with science. Even with those, you have to do more research with those commentaries than with other commentaries where you focus more on your own opinion. There's a negative tone with it. [Why is science hard?] Science based on fact, on data and proving something, and that requires research.*
>
> *I wasn't feeling it. Normally it takes me 15 minutes to type out a commentary, but they had me do it on light bulbs and it took me like the whole two days. (not interested in that topic).*

The Youth Radio staff was aware of the students' lack of engagement, and they reassessed their approach after these workshops. They realized that while Ms. Lehrman brought an abundance of skill and knowledge to the students, she did not have much experience relating to or working with young people. Thus, they brought in former high school teacher Rick Ayers for the next science journalism workshop. While he did relate better to the youths, REA's observations and focus group data indicated that this one-shot event still felt disconnected from the remainder of the Youth Radio curriculum. Moreover, both of these initiatives felt like the top-down learning of school rather than like the youth-driven approach Youth Radio has so successfully implemented throughout its programs.

Core instructor Erik Sakamoto summarized Youth Radio's early STEM programming this way: "*Both of those weren't great in terms of a response of the youth engaged in it. They knocked out some stuff in regards to it but I wouldn't be totally confident that they would pursue it on their own time."* As a result, Mr. Sakamoto observed that these programs were not sustainable.

The Advent of Brains and Beakers

Youth Radio staff realized that the science journalism workshops were not as well-received by the students as they had hoped and that they needed a new approach. What to do next? Inspiration for the next iteration of science-oriented training came through Youth Radio's interactions with David Pescovitz from BoingBoing.net, an online blog about technology, art, science and culture. Mr. Pescovitz first came to Youth Radio to discuss Web site development and design (see New Building case). After Mr. Pescovitz' initial interaction with Youth Radio, he and some Youth Radio staff met in a café one afternoon and brainstormed a new approach to teaching science: give the youth access to exciting, cutting-edge scientists and engineers and have them produce news stories. Explained Mr. Pescovitz:

> *So that's what I like is, not necessarily young people, but getting people excited about science and technology by helping share the sort of wonder of the natural world, the unusual things that you can do with technology and the stuff when it becomes relevant and you understand how it's affecting or could affect your life it becomes interesting naturally when it's not just formulas in a book or a teacher talking at you in a class when you're actually engaged in it somehow. That was sort of the mindset that led to Brains and Beakers.*

At that meeting, Mr. Pescovitz proposed reaching out to the engineers and scientists he knew who were doing interesting and engaging things…and who could convey that to a youth audience. The group decided that the Core students would act as science journalists at the presentations as well as record the sessions to be used in later media productions. They called the program Brains and Beakers and established the following goals:

(a) to create dialogue between youths and scientists;

(b) to engage youth in Core science journalism training; and

(c) to provide role models and challenge stereotypes of scientists

Brains and Beakers in Action

The first Brains and Beakers session featured Tom Zimmerman, an IBM Labs Research Scientist and inventor of the Nintendo Power Glove. The session started with a bang when Zimmerman used electricity to separated hydrogen from oxygen in a plastic bottle filled with water. He then lit a fuse on the bottle to make the hydrogen and oxygen come back

together. The subsequent explosion generated laughter and applause from the appreciative audience.

Zimmerman went on to demonstrate an inexpensive drum he made from "Home Depot technology" – in this case, PVC pipe, a guitar string, aluminum tape, foam and sensors from an electronic drum kit. A Core peer teacher then gave the drum a try, accompanied by a student DJ who added beats using Reason. The room erupted into a high-energy, makeshift jam session with Core students taking turns producing music.

The demonstrations were followed by a group interview hosted and moderated by David Pescovitz. Youths prepared for the Brains and Beakers session by doing background research on Mr. Zimmerman and generating questions to ask him about his work. The questions ranged from the particulars about the technology (e.g., "What's so super about a supercomputer anyway?") to personal questions about his journey to being a scientist (e.g., "What was your first successful invention?") to the portrayal of technology in movies (i.e., does technology represented in movies reflect reality or vice versa?). The youths collected audio and video of the entire session, with the goal of using the recordings to produce a piece about the event.

One month later, the youths had posted their multimedia story about Brains and Beakers to the Youth Radio website. David Pescovitz also featured this video on the Boing Boing website. The final piece used two audio and two video clips to represent Zimmerman's work. Each segment stood alone to describe one element of the session, but they also functioned together as a narrative of the entire experience. The introduction in the first audio piece is representative of the youth-directed tone of the series:

> *Don't lie – how many of you slept through chemistry lab and physics, assuming your schools even offer those classes? Youth Radio joined forces with David Pescovitz from the website Boing Boing.net to launch a series of dialogs between scientists and young people. For our first scientist, we made sure to find someone who can relate to the needs of young people. {Sound clip of Nintendo Power Glove commercial} That's right! Tom Zimmerman dreamed up the technology behind the Nintendo Power Glove. Now Tom's a researcher at IBM, but he also makes bottle rockets and drum machines out of plumbing parts, and he created a device that keeps airbags from killing children. Stay tuned to hear Tom demonstrate some of his inventions and answer and answer young people's questions about science today and tomorrow.*

The video segments began with a youth-designed Brains and Beakers logo followed by 30 seconds of multicultural images of famous scientists (e.g., Albert Einstein, Benjamin Banneker, Flossie Wong-Stahl). The segments showed Zimmerman's explosion and drum demonstrations accompanied by a soundtrack of beats that had been added during post-production. Each segment began with Zimmerman introducing what he was going to do, and ended with images of students applauding or trying out the equipment. Taken as a whole, all of the pieces emphasized the dialogue between Zimmerman and the youths and the highly participatory nature of the experience.

Other Brains and Beakers events featured the founder of a website for the Do-It-Yourself community and a sound engineer and software developer who presented work on creating virtual instruments. The website session was, by all accounts, the least engaging Brains and Beakers because it was the least interactive. In contrast, the third Brains & Beakers turned out to be an eye-opening experience for the Core students.

Prior to the event, Youth Radio Science Producer Charlie Foster led the students through a preparation session in which they conducted background research and prepared interview questions. REA staff observations and focus group comments indicated that while the students expected the presentation to be over their heads, they were able to understand and connect with the research:

> *I expected it to be something I didn't understand because when we were doing research, the paper that we read, it was a bunch of big words and a bunch of stuff she was doing. But, it was cool.*
>
> *When she started off talking, it was complicated, but she broke it down and I understood. I understood it a lot more when she explained it than reading.*

One specific example of the connection students were able to make arose during the interview portion. The presenter mentioned the term "sine wave" in passing when describing a piece of software. One student had just been studying sine waves in school and asked whether the trigonometry that she had been learning was related to the sine waves the presenter was talking about. To the student's audible surprise, the waves were one and the same. Later students asked the presenter if it was possible to write a song using mathematical equations, and could she draw an equation for a song. She said that she could if she had some paper, so one of the students passed her a notebook; she drew a sine wave, which was passed around the room for all of the students to see. The young woman who had asked the trigonometry question continued to talk with the presenter even after the session had ended. In a later focus group, she recalled what she had learned: "*Every sound has an equation. I didn't know that before. I didn't know that.*" During the same focus group, another student produced a notebook where they had copied down the sine wave.

Reactions to Brains & Beakers

Student reactions. Students responded quite positively to Brains and Beakers, in large part because it made science personally relevant and accessible to them … a radical departure from their in-school science experiences. Consider the following remarks from the focus groups:

> *I think they made science look more fun than what a lot of people think it is, because the coolest stuff is actually mostly made by science but not a lot of people know that.*
>
> *I think learning about science and technology here is way more interesting than we do at school because we have to sit down and read. Me, personally, I don't learn by reading; I learn by actually watching and interacting.*

The science of making a drum became so much more powerful when we actually heard them being played with a background instrumental and it was something that was up to date that we got to actually see.

Students mentioned a few ways that Brains and Beakers affected their lives outside of Youth Radio:

It makes you want to think out of the box when I'm in Biology. It makes me think what does that really mean.

[After Brains to Beakers] I was looking up what he [Steve Jobs] did, how he came up to be this person. I thought it was cool.

It was an experience that made me think about going into science.

Staff reactions. Staff members were also affected by their experiences with Brains and Beakers. Erik Sakamoto explained how talking with David Pescovitz expanded his idea of what science journalism could be and how science could be engaging to youth.

Interviewer: What do you think didn't work about it {earlier programming}?

Sakamoto: Maybe it took us a second to recognize that we needed to find a way to reframe science without being too self aware of checking this stuff. Is this science, is this science, is this science? .... Once that David came into the picture I was like well it's all science and technology that he's doing. … As far as what was different, for the young folks … I think they liked what's mixed and they don't like what old folks think is the hip stuff or the cool stuff. They like what you don't like sometimes intentionally. Generally speaking they are ahead of the curve. I think David was able to bring this element where they were like oh okay this dude is ahead of the game. Oh, okay, he's wearing shoes from Recon and oh he has crazy clear glasses and he's cool and he doesn't purport to be cool. If anything he's extremely self-deprecating and humble. But this stuff he's involved with and the folks that he was able to bring through were pretty freaking interesting.

Education Director Lissa Soep also noted that Brains and Beakers allowed Youth Radio to connect with Silicon Valley inventors and engineers whose life experiences could inspire the youths:

I felt like what a thread that ran through all of what they had to say was your questions and your curiosity and your instinct to kind of tinker and open things up and notice the things that don't exist that you wish did exist and lean into that. I feel like that was a place where I saw even just in the questions they would then ask in follow up or the kinds of stories that people would then pitch. It seemed like that was a shift in perspective or that seemed to me really inspired by really having encounters with people who have been able to make a life around that kind of thinking.

Also I think it has been important for them to see the kind of hard work that comes with that that it's not just an overnight success. Oh, I decided to invent a data glove that allows you to simulate, it's like they hear all the school that goes into that… I think is also important for young people to see that they can identify with that but also feel entitled to it. That's work I'm willing to do to be able to make the things that I want to make.

Beyond providing the students with a glimpse into the mind of an inventor, this series also exposed students to scientists and inventors as *people*, possibly even like them. For instance, imagine the youths' surprise when they found out the person behind the high-tech, complicated research they struggled to read during their prep session was a young African-American woman who loved music and creation. But, the students were not the only ones surprised by what they found at Brains and Beakers.

Presenters' reactions. Just as Mr. Pescovitz was impressed with the Youth Radio students' energy and interest and wanted to continue his involvement with them, the presenters found themselves wanting to do more. Tom Zimmerman continued to do two other events with Youth Radio (see below).

Presenters also praised the students for the novelty and depth of their questions, as well as their level of preparation:

> *What surprised me most, as I said, was sort of the level of questions that I was getting which came from the background research. People were digging into these people and papers and articles about them and just doing real background, professional level journalism background research before interviewing the subject. They were learning a lot. Frankly, I don't see that a lot in professional journalism when people are interviewing scientists.* (David Pescovitz)

Mr. Zimmerman was equally positive about the quality of Youth Radio and its students:

> *Usually, most people who interview me are very linear, very just focused on the project I'm doing. What I found about the Youth Radio is that it was much broader and wider. How I got interested in science, what my motivations are, and what really blew me away was this one ethical question, maybe it was what this fellow had been pondering about and it had little to do with the projects I was showing but it was more of an ethical question of scientists and responsibilities in the work. If I were to do a project that would also harm people, did I have a responsibility to keep it from harming others, and it just shocked, surprised me that a young person would ask such a deep question. I was quite impressed that they (a) cared about such things and (b) would ask that question.*

Follow-up: Drum Making Workshop

Tom Zimmerman had such a positive experience at Brains and Beakers that he wanted to sustain that connection. Based on youth interest in the homemade drums Mr. Zimmerman demonstrated in his presentation, he and Youth Radio staff decided to offer students a follow-up opportunity to experience the drum-making process for themselves. Mr. Zimmerman is also the Co-Principal Investigator for the Extreme Experience Lab, an NSF-funded Innovative Technology Experiences for Students and Teacher (ITEST) project in San Jose. He came up with the idea of bringing the two groups together for a skill and idea exchange:

> *So I thought about it, and I thought of this idea of doing a barter where I would run an electronic drum workshop for some Youth Radio students in exchange for them teaching some of my students, which is junior high school in East San Jose, teaching my students multi-media production, particularly video editing. I thought it would be great to get the students together, students teaching students, and bring*

my Latino students to meet the diverse population of the Youth Radio students as well, kind of a cultural exchange.

In all, the Youth Radio students spent two Saturdays with Mr. Zimmerman and his students, building drums and documenting the experience.

This workshop provides one of the best indicators that Youth Radio's new approach to STEM was generating interest and sustainability – among the outside partners and participants and the Youth Radio staff and students. All of the students who attended the workshop did so voluntarily – it was not part of any class – and on their own time, outside of their usual Youth Radio work hours. Tom Zimmerman felt part of the reason for this student engagement, as well as his own interest in working with Youth Radio, stemmed from the intersection of arts and science:

I also loved what Youth Radio was doing, teaching multi-media, something I've been interested in, too, as a technique to rope in non-science students and get them interested in science, and realize that to do cool things in art and music, science and technology can help.

Like David Pescovitz, Zimmerman discovered a connection between his own work and interests and Youth Radio's. This connection led to an ongoing partnership. The final case examines two other science journalism partnerships.

Case 4: Expanding STEM Through Community Partners

Having established and expanded their science and technology training within their existing programs, Youth Radio began to develop relationships with addition STEM organizations and projects. This case highlights two of those partnerships. Both involve STEM reporting, but in quite different ways.

The California Academy of Sciences

In Year 3 of the grant, Youth Radio Oakland developed a partnership with the California Academy of Sciences (a.k.a., the "Cal Academy"), a San Francisco natural history museum that had recently reopened its doors in Golden Gate Park. The partnership emerged from a prior relationship between a senior producer at Youth Radio and Molly Michelson, the Science in Action producer for the Cal Academy. *"We were just sitting at dinner one night and we're like this seems like a no-brainer, let's just go for it,"* Michelson recalled.

Youth Radio students and staff contributed to the Cal Academy's Science in Action exhibit and participated in NightLife, the Academy's Thursday evening event for adults. Michelson explained that Youth Radio was a good fit for the Cal Academy because of its resources and youth focus:

> *I saw it as a way that we could share resources, their youth reporters and maybe some of our footage or stories we could somehow share that, where we don't have the audio capabilities that they have. They obviously have that, and they have a great core group. The age range is really the age range that we're looking toward for Science in Action and NightLife as well. So it seemed like a very good fit.*

Science in Action. Science in Action uses a video-display floor exhibit, blog, podcasts, guest lectures and science mixers to inform visitors of contemporary science issues. For their video display content, the Cal Academy frequently wanted to interview people across the country but did not have the technology to record those interviews remotely. Youth Radio's new facility did have these resources, so the organizations decided to work together on several pieces for the exhibit.

Two of the stories worked on by Youth Radio Newsroom interns, *Darwin Awards* and *Toxic Schools,* a video on air pollution in schools, were included in this evaluation. In both cases, the Cal Academy prepared interview questions for the Youth Radio interns to ask and record. (While the interns also generated their own questions, these were not necessarily to be included in the final Science in Action pieces.) The students then narrated the Academy-composed voiceovers for the final pieces.

One intern who worked on these pieces appreciated the opportunity to do voiceovers for a video production. Compared to the audio-only stories she had narrated for Youth Radio, *"your voice or the way you sound has to go somewhat with the image of the way it sounds. … I had never done a voiceover for the video like that before so it was definitely new and it just taught me how to transition from radio to video in a way. So that was helpful."*

This intern's understanding was that the Cal Academy wanted a young person to narrate the pieces because youthful voices are fresh and catchy, *"I think we as young people can be kind of flexible in the way we say things or we can say them playfully and it just kind of comes out natural."* She was quick to point out, however, that young person's voiceover was not the same as providing a youth perspective on an issue, something she had grown accustomed to at Youth Radio.

Ultimately, the intern felt that working on the *Darwin Awards* piece *"was a great experience but it was definitely not a youth piece"* because it was written by an adult outsider. How would the story have been different if it had included a youth voice? According to this student, a young person would have asked more questions to clarify the purpose of the Darwin Awards and their relationship with science:

> *We tend to be kind of less fearful and we tend to challenge things more, so I think is kind of missing on it. Because when were listening to it we were checking the stuff out like the actual [Darwin Awards] website and we were like hmmm this is interesting. It has something to do with science so that was when we started thinking where is the connection coming.*

The intern admitted that she didn't even know who Darwin was and might have done more research about him had she been in charge of the story.

B&B at Nightlife. For their second collaboration, the organizations decided to bring Youth Radio's successful Brains & Beakers series to the Academy's Thursday NightLife. They put together a program called "Mad Science" that featured performances and demonstrations by Tom Zimmerman and his PVC-pipe instruments and TradeMark Gunderson, founder of the mash-up band Evolution Control Committee and inventor of the Thimbletron and VidiMasher 2000, two electronic devices that allow for live digital music sampling and mixing.

Once again, this combination of music and technology created a high-energy atmosphere. After demonstrating their inventions and the science and technology behind them, the presenters invited audience members to come up and play the instruments and create mixes. Most were shy about doing so at first, but once the official portion ended, a large number stayed to ask questions and try out the inventions.

The Cal Academy staff praised their efforts and the audience it attracted: *"hip and cool, like the Youth Radio folks"* (Molly Michelson). Ms. Michelson further observed that some of the Academy's audio-visual technicians proclaimed it, *"the best program we've had at NightLife so far."* According to Lissa Soep, some of the audience members sent Youth Radio positive emails about the event.

With this Mad Science event, the Cal Academy wanted to attract more young people to NightLife and Youth Radio wanted to increase the organization's visibility within the science and technology community. On both of these fronts, this collaboration proved successful. In terms of direct youth benefit, however, the event had less to offer.

Youth Radio had originally planned to bring several students to help document the event. That plan fell through when the Academy restricted the event to adults 21 and older. Ms. Soep expressed some disappointment at this development: *"It was just kind of a blow to our youth development commitments and it just shifted … it was actually a lot more work because we couldn't rely on our students to shine the way we knew they would."* Nevertheless, Ms. Soep was pleased with the positive attention to the organization as a whole that the experience generated.

Both organizations approached this partnership somewhat cautiously. Lissa Soep explained *"That's usually how Youth Radio has had success building partnership with starting with something small and concrete and often making something together just so we can get a feel for how we work together and do we really complement each other."* So far, the organizations agree that each has something to offer the other. Unlike some other Youth Radio collaborations highlighted in this report, though, the direct link between interests and missions has been more difficult to locate.

While the Cal Academy focuses on educating a large population about science, the Youth Radio's directive is to empower youth to express themselves through media. Those missions conflicted somewhat in the production of the Science in Action pieces. The Cal Academy gave youth some leeway for self-expression by allowing them to ask their own questions, but ultimately controlled the content and production of the final piece. The partners' initial activities were consequently more of a resource exchange than a true, equal collaboration. As Cal Academy staff get more acquainted with youth work and youth capabilities and as Youth Radio staff become more familiar with Cal Academy projects and opportunities, it may be possible to create activities that optimize the benefits for the organizations and their members (young and old). Some awareness and change appear to already be in place on both sides. The challenge becomes how to take those changing attitudes and expectations and translate them into actionable events and programs.

Moving forward, Youth Radio and the Cal Academy would like to increase youth participation in partnership activities and are considering the best direction to take. The Science in Action program planned to produce a number of one-minute stories and was considering producing some with Youth Radio. Observed Ms. Michelson, *"So we've just hit on this great formula for our stories, so now that we're kind of in the stride for that I'm hoping to get Youth Radio involved some more."* She has seen some pieces Youth Radio has done: *"I'm hoping, they're doing such great work that I'm just hoping somehow we can figure out another way to get involved, share resources, and share a story."*

Mobile Youth Voices

As with the Cal Academy partnership in the Bay Area, Youth Radio Los Angeles took advantage of an established relationship to create a new opportunity for students to engage in STEM. In this case, former Youth Radio L.A. staff member Sara Harris, co-founder of the Mobile Youth Voices project, invited Youth Radio interns to participate in an innovative experiment in participatory journalism and collective storytelling. In contrast to the other STEM journalism discussed in this report – and engaged in by Youth Radio, this project is not *about* science or technology. Rather, it uses new digital media technologies, namely cell phones and social networking sites, to report on bus and transportation issues in the Los Angeles area.

In the first phase of Mobile Youth Voices (the portion completed during the grant period), Youth Radio interns and staff worked with Ms. Harris to pilot the project. First, they created a space for the project on Utterli, a social networking site that allows one to upload content – text, photos, and video – from cell phones as well as computers. This space served as a data collection site for the project. Then, students and staff were asked to use their cell phones to report on transportation issues live, whenever and wherever they were happening. Later, these posts are to serve as a database from which reporters can produce transportation stories, such as troubles encountered with the implementation of new transportation passes and late or no-show busses.

This high-tech and transportation-focused story fit well within Youth Radio L.A.'s interests. By necessity, this bureau operates differently from the Oakland headquarters. The widespread makeup of Los Angeles makes it difficult for the bureau to establish a central, community location. Rather, the staff works within a variety of local schools and youth organizations and conducts bi-weekly, optional, newsroom meetings at an Art Share in downtown L.A. For the largely low-income youths who become News interns here, both technology and transportation play important roles.

Youth Radio L.A. interns must be highly motivated to participate in the program. In comparison with Oakland, their experience is far less structured. The bureau uses the Art Share as a meeting place because it is easily accessible via public transportation. Still, students have to travel from all around the widespread Los Angeles area, an often frustrating and time-consuming process. As a result, much of their interaction with each other and with Youth Radio staff occurs via new technologies.

Whether the Mobile Youth Voices project turns out to be the next evolution in journalism or a passing fad, only time will tell. Regardless, through their participation, Youth Radio L.A. interns received a first-hand experience with a new way of reporting on the cutting-edge of digital technology and Web 2.0 capabilities. Moreover, these students were exposed to the research community when they participated in a conference panel on the project. Ultimately, both of the projects discussed in this final case are in their nascent stages and are part of the STEM journey Youth Radio has embarked on and plans to continue.

Summary: Youth Radio's STEM Journey

In general, Youth Radio's STEM programming funded by the NSF grant consisted of two primary components:

- A Digital Technology Institute, an intensive after-school training program for youth that focused on media technology production and engineering skills; and

- The Science Desk, an intensive after-school training program in science journalism, where participants developed and reported on science news stories of significance.

Within these strands, Youth Radio has expanded the opportunities for students to learn about and engage with science and technology in a variety of ways. This multi-faceted approach has given students the opportunity to explore STEM skills and issues and to discover which ones interest them. These new opportunities have led to a number of key outcomes, for instance:

- Youth Radio expanded students' opportunities to engage with STEM through the new building and curriculum and new partnerships and initiatives.

- Staff and students (and guests) discovered that the students were capable of more than they anticipated with science and technology.

- In the process of engaging the science community, Youth Radio broke down stereotypes on both sides. Students discovered that science was not what they thought it was in school, that inventors can be cool.

- Youth Radio discovered that common goals and interests were the keys to successful and sustained partnerships.

- Most importantly, the organization discovered that successful and sustainable STEM programming needed to be incorporated into their student-driven model of high-quality production and youth expression.

Arriving at this place of enriched STEM opportunities throughout its programs required facing challenges and instituting a series of changes – both within the organization and staff and with the youths they serve. This journey and the programs produced offer insights into the process of organizational change, the significance of community partnerships, and the connections that can be made between science/technology and the arts.

Youth Radio has had a long-standing program of youth development and training through media production. As the general analyses and comments from students demonstrated, the organization's approach to its core mission has been highly successful. Further, Youth Radio has been able to adapt their model in multiple locations to fit different resources while maintaining core goals and functions. With the approval of the NSF grant, their primary challenge became how to incorporate science and technology content and activities into their established and successful model of youth-driven media production.

That's not what we do. Some of the organizations early attempts to incorporate STEM journalism proved to be less than successful. These efforts, such as bringing in professional science reporter Sally Lehrman, felt "added on," outside the flow of the curriculum, and therefore, forgettable. Students created STEM output, but these activities did not capture their interest. As it turned out, the students' lack of engagement also reflected a certain ambivalence toward STEM on the part of the Youth Radio staff, as well.

Youth Programs Director Erik Sakamoto admitted that he was initially skeptical about how the ISE grant had any relevance to the youth he served:

> *To be honest, my initial response to it as a youth worker was like that's not what they're here for. From my perspective we were always vested in getting them where they're at and certainly by being aware of funding and how difficult funding can be and yes we're going to do this but it's going to be a hard environment adjusting stuff. It's going to be a lot of this stuff that you're concerned about and you're going to describe it and try to figure out how that's science.*

By the end of the grant, however, he understood STEM-related programming was consistent with Youth Radio's mission of addressing students' interests and needs:

> *But I don't know what happened. Certain things changed and maybe hopefully that's what the young folks have had happen as well where there was something that they liked like maybe midway through the grant and maybe having a little bit more I guess investment in the grant and having a little bit more latitude in how we pursued this grant.*

Sakamoto's new perspective developed when he began to understand and define science differently (much as the students would be encouraged to do):

> *This thing popped up where was David [Pescovitz] was really clear about science is just like having a question and trying to figure out how to get that answered. A lot of things, just for myself where I'm like okay that is where they're at because we're going to have them answer these questions that they're interested in. We're going to try to give them some tools and support to get an answer to that question.*

This change in perspective took time, but it eventually led to the development of initiatives like Brains and Beakers that did successfully engage students with STEM:

> *You could look at this grant as a long ass process like three years where I would argue that we got really, really strong at the end. That's probably kind of like the youth interaction with the science stuff here has been like. They started off maybe like me and kind of got to the point where they're like okay I'm just going to answer some questions and ask some questions and then figured out how to answer the questions.*

Science as a verb. Youth Radio staff members' beliefs about science and its fit with their organization changed/expanded over the course of the grant. Originally, staff members defined science as a noun, that is, they represented their programming in terms of the subject matter students would be covering (e.g., natural disasters). By the end of the grant, they were defining science as a verb, as a way of answering questions and using data to gather answers. This approach allowed staff to fit science programming more easily into Youth Radio's overall mission.

Beginning of grant	End of grant
• Science is a noun (product) • Science as a proprietary set of isolated skills	• Science is a verb (process) • Science as a universal, curiosity-driven form of sense-making/

The initiatives examined in the case studies of this final evaluation report demonstrate this shift. They offer evidence of the new learning opportunities and expanded partnerships Youth Radio will be able to pursue with this broader understanding of science. Because most of these initiatives developed late in the life of the grant, evaluators were only able to collect limited, mostly qualitative data on student outcomes. To the extent Youth Radio has the resources to continue and expand these STEM programs, evaluators would expect to see even more changes in how students view science and technology. It would be interesting to see whether their definitions of science also change from a noun to a verb.

Appendix of Survey Instruments