

The Community Science Workshops: A Report on Their Progress

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I. AN INTRODUCTION TO THE COMMUNITY SCIENCE WORKSHOPS

It is 3:15 on Monday afternoon. A young African American girl enters the shop at John Muir Middle School. "Hi, Rita! How are you?" "Hi, Mr. Gray." She puts her backpack in a locker and takes out a project she has been working on – two pieces of PVC pipe with L connectors on one end. She heads to a work table, places the pipe on it, puts on a pair of goggles, and begins to search for a piece of wood to use to mount the pipe on. "What are you working on?" "It's going to be a wave-maker – like the one over there." She points to an exhibit along the far wall. She measures the size board she will need, using the exhibit as a model, then heads for a hand saw to make the cuts. Across the Workshop, another student applies blue paint to the boards she will use to make a table. Nearby a few more young people play with exhibits along the back wall, while two more are busy making paper cup motors.

What Are The Community Science Workshops?

Funded in 1994 by a National Science Foundation (NSF) grant, the Community Science Workshops (CSWs) are an important new invention. Neither school nor science museum, the CSWs are an unusual kind of institution. They are part science center, part wood shop, part nature center – all in the heart of urban neighborhoods throughout California. Located in community centers and schools, they attract youth from local neighborhoods who drop in after school and on weekends. At these places, children, mostly eight to twelve year-olds, play with home-made exhibits. They also build their own birdhouses, stereo speakers, hydraulic cars and robots. They care for snakes and fish, and examine pond water under microscopes – all the while working with other youth and caring adults.

CSWs are community centers devoted to providing local youth with opportunities to engage in their own projects and to pursue their own firsthand learning. Filled with science, technology and art, these Workshops offer young people alternatives to gangs, drugs, violence and boredom in neighborhoods where there are few other positive opportunities. Twelve Workshop sites currently exist in eight urban communities throughout California: Los Angeles, Oakland, San Francisco, Watsonville, San Jose, San Bruno, Fresno and Stockton.

Although each of the CSW sites is unique, they all share certain common characteristics. All have directors and staff who are science aficionados, community activists, and youth advocates. All sites place an emphasis on minority youth exploring and pursuing their own ideas, through observation of phenomena, building projects, and inquiry. They all have simple, easy to construct and de-construct exhibits demonstrating science concepts for children to explore, as well as a rich collection of tools and materials for experimentation. And all are situated in urban settings in the heart of minority neighborhoods.

Documenting the CSWs: This Report

Inverness Research Associates has been documenting the establishment and development of the Community Science Workshops for the past five years.¹ This report portrays the CSWs for audiences who have not had the opportunity to see them for themselves. It describes the genesis, development and growth of the Community Science Workshops. It also describes the CSWs from the point of view of the youth they serve; the program staff who develop and run the Workshops; and the local community who are served by the Workshops. The report also examines the economics and the sustainability of the Workshops, a dimension of central interest to potential funders such as NSF. It shares some of the lessons learned about developing new Workshops which may be useful to those who are interested in establishing similar Workshops in other communities in the future. Overall, this report is intended to document the benefits that have accrued from the NSF investment in what we see as the CSW “experiment.”

As we began our study, we realized that the new institutions would have to be successful at different levels simultaneously. Therefore, we studied how the CSWs served the youth of the local neighborhoods; how the leadership developed their programs; and how they created institutions that would be valued enough by their local communities so that they would be sustained locally.

Our evaluation and documentation activities included: conducting annual visits to the sites as they were established; interviewing site directors and other staff on a periodic basis; interviewing and observing the youth participants; interviewing parents, teachers, and community members involved in the Workshops; convening meetings of the CSW network to identify and analyze

¹ Inverness Research Associates is a private evaluation and research firm located in Inverness, California. They are engaged in the study of many initiatives aimed at improving mathematics and science education across the country, as well as projects that work with under-served youth. For more information about the firm, see their website at <http://www.inverness-research.org>.

lessons learned; and administering surveys to site directors.² We also participated in site director workshops and special events at the various sites.

This report is organized into several different sections. In this first part we provide the reader with a brief history and overview of the CSWs. In section two we describe the nature of the CSW experience as it serves youth in urban neighborhoods. Then, in the following sections we describe in considerable detail the nature of the achievements of the CSW initiative to date. These achievements need to be understood at different levels, including the value of the Workshops to under-served youth, the scale and nature of the programs they offer, the contributions to and connections with the local community, and the establishment of new and sustainable institutions. In Appendix A we provide the reader with more detailed descriptions of each of the CSWs, and in Appendix B, we provide the results of our survey in graphical format.

² The source of the statistical data in this report is a survey of the site directors we administered in 1999, for the period June 1998 through June 1999. Selected data from this survey are included throughout the body of the report; more complete data are presented in Appendix B. For an explanation of the data and definitions pertaining to this report, please see "Technical notes and comments on CSW data collection and reporting" at the front of Appendix B.

The Origins: Mission Science Workshop

The origins of the Community Science Workshops can be found in the Mission Science Workshop which is located in the Mission District of San Francisco, California, a predominantly Hispanic community. The Mission Science Workshop started in the early 1990's in the garage of Dan Sudran, a self-taught scientist who himself lives in the Mission. With a long history of community activism and organizing, Dan was interested in serving the children of the Mission district. Dan was also a teacher and a graduate of the Exploratorium's Teacher Institute.³ At that time, Dan confirmed for himself the value of learning through investigation, experimenting and building things. During the late afternoons, Dan was often in his open garage tinkering with simple machines and tools.

Kids between 8 and 11 years old started coming by and began to realize that they didn't want to just ride bikes. Instead, they wanted to play around with oscilloscopes, look at different things under microscopes, and look at rocks.

Realizing that many of these youth shared the same curiosity for science and the same love of "tinkering" that he had, Dan began an informal drop-in program in his garage, and looked for sponsors to help him fund and house a more permanent "neighborhood science center." He continued to seek out ideas and support from the Exploratorium and he found other enthusiasts and like minds for his project in the Teacher Institute program.

In 1992, as a result of the backing from the Teacher Institute leaders, and as a result of Dan's ability to articulate and share his vision of a community science workshop, City College of San Francisco donated a space on the second floor of their Mission Campus building to house the new program. Today this facility is filled with more than 50 exhibits, microscopes, live animals, marine plants in aquaria, and Workshop tables. It is also filled with many different kinds of programs that allow children, teachers and parents to be creative, to pursue their own interests, and thus to "do" science. The Mission Science Workshop provides a much-needed place for youth to be after school and on weekends, where they have the opportunity to play with exhibits, build their own exhibits and other inventions, and, at the same time, form relationships with one another as well as with caring adults. Dan explains:

³ The Exploratorium is a hands-on interactive museum focusing on science, art and perception in San Francisco. The Teacher Institute program at the Exploratorium has existed there for almost 20 years, and focuses on helping secondary teachers teach science through an inquiry approach.

Here kids do things they are interested in and we provide them with the materials. But we are also providing kids with positive interactions with adults who are willing to spend time with them over a number of years. Some kids don't have these adults in their lives and that is one reason they come back; they bond with certain staff members. The Mission Science Workshop is like an oasis for them.

Over the years the Mission Science Workshop has continued to grow a core staff which has represented a wide array of personalities, most of whom come directly from the surrounding neighborhood: a farm worker organizer, a former Mission neighborhood gang member, a Mexican immigrant with 20 years experience as a bilingual science resource teacher, an art teacher, and a former physics professor.

Also, in addition to the original drop-in program which still serves as the backbone of the MSW, programs at the Workshop have included other foci including projects specially targeting girls, Saturday field trips, family nights, and teacher workshops. These programs serving local youth and teachers have received support from a wide variety of funding sources at the city, state and national levels.

The Mission Science Workshop resulted from a strong grass-roots community effort and was successful beyond even the most optimistic expectations. Both in its form, and its development history, the Mission Science Workshop had the potential to offer a valuable model for creating a new kind of community program that could serve local youth – many of whom would be categorized as being highly at risk of failure, or of very poor performance, in formal school settings. The success of the Mission Science Workshop begged the question: Could such a program, so sorely needed in urban communities throughout the state, be replicated successfully in other neighborhoods?

The CSW Grant: Replicating the Mission Science Workshop Model

- The Origin and Purpose

In 1993, Paul Fonteyn from San Francisco State University and the staff at the Mission Science Workshop formed a team to seek funding from the National Science Foundation. Their goal was to further the work of the Mission Science Workshop by creating satellite Workshops that could serve other similar communities. Paul works in the Development Office of San Francisco State and is a skilled grant writer; more importantly, he became personally committed to the vision and promise of the program. Paul's expertise in and familiarity with the funding process and the state legislative process added a great complementary strength to the highly developed science teaching and "tinkering" skills that already existed in the Mission Science Workshop staff.

As stated in the original proposal (February 1995) MSW and San Francisco State University, in cooperation with the Mathematics, Engineering, and Science Achievement (MESA) program, proposed creating fifteen community-based workshops throughout California. The original proposal stated:

These workshops, in partnership with local school districts, will provide science activities for K-8 children and parents residing in ethnic minority communities in both urban and in rural areas... who generally are not provided opportunities to participate in such activities.

Thus, the proposal explicitly set out to bring new institutions rich with science and inquiry into the heart of mostly minority communities. The goal was to create workshops like the one in the Mission that would enable minority youth to participate in high quality, inquiry-oriented science, mathematics and art activities after school, on the weekends, and during the summer. The workshops would also seek to involve parents, teachers, and community members in programs as well, through family night activities, field trips, and teacher workshops. Simultaneously, the goal was to create effective partnerships in these communities between existing agencies, programs, school districts, universities, science and technology centers, and community centers – all in the service of bringing high quality learning experiences to the youth who live in these communities.

- Establishing the CSW Sites

When in 1995 they learned that they had indeed received NSF funding, the Mission Science Workshop staff set out to identify potential new communities and Workshop sites within those communities. They had some key criteria in mind. While they knew of several communities they thought would truly benefit from a Workshop, they wanted to make sure that the Workshops could be developed in those communities in ways that would make them most accessible to the populations they wanted to reach. They also wanted to develop new Workshops in ways that would maximize their chances for achieving long-term sustainability. There were two criteria involved:

Establishing the location of the Workshops was one of the first criteria they had in mind. Staff felt that one of the “non-negotiables” of the MSW model was that the Workshops be located in the heart of a minority community. Thus, they set out to find locations that would be accessible (primarily on foot) to the local children.

Finding the “right” person to run each Workshop was the second criterion. MSW staff paid a great deal of attention to identifying the primary person in

each location to work with the youth. They looked for people who were part of the community and who would relate well with the children. They looked for people with knowledge of science, but who also had a natural bent for solving problems through exploration and “tinkering.” Thus, as sites were selected the Mission Science Workshop staff went through an arduous process to hand-pick both the sites and the right people to direct them.

In 1996, it was decided to reduce the goal for the number of new sites to ten.⁴ The sites were established a few at a time, beginning with the Brookdale Discovery Center in Oakland, California, which was already in existence as a program prior to receiving the NSF grant. The second site to begin the first year of the grant (1995-96) was at Capuchino High School in San Bruno. Five additional sites were added in 1996-97: The San Jose Science Workshop; the Los Angeles-University of Southern California MESA Mission Science Workshop; the Fresno Science Workshop; the Bayview-Hunter’s Point Community Science Workshop;⁵ and the Stockton Workshop. In 1997-98, a site was opened in Watsonville.⁶

As each new site has become established, Mission Science Workshop staff have provided them with a variety of supports in addition to the NSF funding they received. They have personally mentored the new site directors, offering one-on-one assistance both at the MSW San Francisco site and at the new Workshop sites. They have also organized professional development sessions for the new site directors, which have allowed them to come together as a group – and over the years this has resulted in the development of a network of CSW site directors. As the parent organization the MSW has also provided materials and ongoing assistance as each of the new sites have pursued their own local sources of support and sustenance. The MSW has served as a central node of the CSW network, overseeing the National Science Foundation grant, and providing leadership and guidance for all the network sites. The program that began in a garage has grown to include a viable group of Community Science Workshops throughout California.

⁴ For a more detailed explanation of this, see the section “The Importance of Pacing the Growth” on page 40 of this report.

⁵ At the time we conducted the final survey for this report the Bayview-Hunter’s Point site was closed; data for this site are not included in this report.

⁶ For a description of the sites we studied that are still operating, see Appendix A.

II. THE COMMUNITY SCIENCE WORKSHOP EXPERIENCE

Randy, age 14, is a Chinese-American. For one of his projects, his goal was to build a small, battery-powered car, improving on the model that the site director had made earlier. Instead of wood, Randy decided he was going to use foam core as a base, "just to see what happens." He thought maybe if the material was lighter, the car would move faster. But there was a problem: the foam core was too light, and the car wouldn't get traction. Using problem solving skills, Randy experimented with weights – he tried several different ways of solving the problem. Finally, he tried putting rubber bands around the wheels, and that worked. He was very excited and pleased with himself!

Key Characteristics

As we studied the Community Science Workshops we grew to understand that they were truly a new kind of community-based institution that could provide under-served youth with meaningful, firsthand science experiences. As we have mentioned, a Community Science Workshop is not a science museum, a school classroom, a recreation center, nor a typical after-school program. For the reader who has not been able, as we have, to spend several hours observing an afternoon at one of the CSW sites, we attempt to portray in the following section of this report some essential features of the CSW experience.

Although the CSWs vary in their size, staffing, and programs, there is a shared philosophy and culture that is recognizable at each of the sites and clearly derives from their common heritage. Each Workshop site offers its youth participants a similar core experience that includes playing with exhibits, learning about tools and investigating questions and interests through exploration, invention and construction.

First and foremost, the CSWs are very much participant-centered, materials-rich, and inquiry-based. That is, the decisions about what gets done, studied, or created are made, for the most part, by the children themselves. Participants are offered exhibits and sample projects, and a wealth of materials with which to "mess about" and experiment. Then, guided by adult staff, they decide on a project to create or a path of study, and pursue it. They take as much time as they want, while the adults facilitate the use of the tools and the understanding of science concepts behind the projects. In short, the youth are introduced to the art of "tinkering."

Many of the young participants in CSW live in a world that consists of school, home, and dangerous streets. Thus, while the experiences at a Workshop may seem run of the mill to youth from a more privileged background, for these

children the CSW experiences are truly rare and even eye-opening. For example, one young girl explained to us how she went about making a go-cart. She listed off all the steps of the process (i.e., put on an axle, make the seat out of wood, brace it, saw wood with the help of an older youth, etc.) Surprisingly, she said painting the go-cart was the most fun, because she “never had painted before.”

The Exhibits

One activity available to youth at most of the Workshop sites is using exhibits, many of which are modeled after full-scale Exploratorium exhibits. While inspired by exhibits at the Exploratorium, the CSW versions are typically less polished looking and less expensive. That is, they are more home-made in appearance, and most importantly, make apparent how they were constructed. They serve as inspirations and models for projects the youth want to build, as well as catalysts for thinking and speculation. As one boy told us:

Sometimes I might finish with a project and so I go to the exhibits... That gives me something different to do... There is a telephone that I think [Mr. Gray] made and it is kind of cool. I will sit there and play with it for a little while, and then I will just think about it....

Using Tools

Juan, a nine year-old Latino boy, comes to the Workshop almost every day. He has taken several of his finished CSW projects to his school and explained them to his class. He likes making projects that he can give to his mom as gifts. When he goes home with projects, he gets to reflect on them further when he tells his mom how he made them and how they work. He expressed amazement that he makes the projects himself and they work. He explained how he made a fan. “I started by looking at the model.” Then he cut a small piece of wood, drilled a hole for a cable, nailed two pieces of wood together, connected a switch, battery and a motor. He made the blades of the fan by drilling a hole and connecting a dowel with a nail in the center. As a native Spanish speaker, an added benefit for Juan was that working on projects was a good way to learn English vocabulary. He has learned the names of equipment, tools, and materials.

CSWs provide disadvantaged youth with opportunities to learn how to use many different types of tools. Learning to use tools has been, in the past, a standard part of the curriculum available to many middle and high school students, but increasingly schools are eliminating “shop classes” and closing their wood and metal shops. For the most part these old shop rooms and classes have been replaced by technology labs and courses which focus on developing computer skills. As a result the chance to use hand tools and to work with

physical materials is an experience that is frequently unavailable to the youth in the neighborhoods being served by the CSWs.

As we visited CSWs, we routinely observed third grade girls expertly wield scroll saws. We saw boys using hand saws and grinders to craft robots and go-carts. Soldering and hot glue guns, as well as more standard tools such as hammers, nails, pliers, screwdrivers, etc. are a staple of most Workshop sites. For many youth, being able to construct something of their choosing, combined with learning the tools and techniques to complete the project, is a powerful combination. As one youth stated:

I learned how to use a drill better than what I did before, drill screws better than I did before and cut wood better than I did before. [I] learned how to use magnetized robots, connecting a speaker up to an amp on the radio... I learned how to take apart things – lots of motors, computers and VCRs and old tape recorders that people didn't use ...

Another girl told us:

I like coming here. I like using the tools the most, and being able to build something that I want to build.

Still another participant said:

Before I started coming here, well, I didn't know how to do nothing at all. Now since I am here, I know how to do certain things, like make a house out of wood, or whatever. Usually, I would just know how to draw that.

Learning Science

Learning science content is also a part of what happens on a daily basis at the CSWs. Such learning happens in both a direct and indirect fashion. In designing and creating their projects, many participants at the CSWs come to interact with important scientific ideas on their own. At other times the teaching of science is more direct, as more traditional science learning experiences are also offered to children there. For example, at one Workshop, dissections are part of the activities on Saturdays. One boy told us that he liked the dissections. He also said that he was pleased to realize that when he had participated in a cow's eye dissection in his school biology class, he already knew about a cow's eye because he had already dissected one at his CSW.

Another participant described the kind of science he had learned through his CSW experience:

It's fun here! So far, I have learned about gravity, colors, and about magnets, currents, and electricity.

One of the CSW directors reported that a youth decided to make a remote controlled bulldozer based on an exhibit in the Workshop. He had to use different materials than those that were used in the exhibit because wood was the only material available to him. "He made the whole thing with wood, nails, and string and he had to use different mechanical principles to get his bulldozer to do the same thing as the one made from metal." This child's project involved a lot of thinking and understanding of some physical principles, and in fact, the site director remembers it as one of the most memorable projects he has observed.

Learning For Oneself

A key tenet of the CSW philosophy is learning for oneself. Youth are encouraged to select, on their own, what they want to work on. They are also encouraged to work independently with exhibits and tools as much as possible. Part of the CSW ethic is also a fundamental trust in the value of working with real phenomena and real materials. In contrast to the "virtual reality" of television and video games, the CSW approach is to allow youth to interact with "material reality," learning lessons through the interaction with and inquiry into materials.

One site director explained how he facilitates youth learning:

Most of the things I deal with here at the Workshop are low-tech. I want the kids to find out some simple things about how things work and to come across some basic science concepts first. As the kids progress, they will then go on to a lot of high-tech stuff...

I try to give them as little help as I can. I tell them, "Sure you can build a big project here right now. You can build a car, but I am not going to help you." At that point, the kids begin having to solve a lot of problems, about friction, about all sorts of things. And they really have to start thinking about how spatial relationships play a part in things. There is so much thought involved in making something like a motorized, rubber band car... But it teaches them...as they build these things how to think it through in their head.

I think that what really makes a scientist is not how many facts he [or she] knows, but how the person can put together the facts ... so I encourage experimentation.

Kids will learn if they are allowed to experiment and make mistakes instead of simply being handed a set of instructions... And I think this experience at the Workshop in a way may be most important for kids who don't have parents and family involved in the sciences, who don't actively watch their father and mother solve problems of this sort at home...

III. THE ACHIEVEMENTS OF THE COMMUNITY SCIENCE WORKSHOPS

Introduction

The Community Science Workshop grant provided funds for the establishment of new Community Workshops around California. In order for this grant to be successful the work of this project had to succeed at several different levels:

- Serving the Youth of the Community: The Workshops had to identify, recruit and successfully work with the youth they targeted – that is: those who are traditionally under-served in terms of opportunities in science education, who live in mostly minority communities, and who often do not succeed in traditional classrooms. The Workshop experiences had to be both valuable and interesting to these youth.
- Designing Programs: The Workshops also had to design and implement a variety of programs that could serve youth and other members of the community in ways that met their needs and interests.
- Connecting with the Community: The Workshops had to create linkages with existing community organizations and ultimately be seen as a valuable entity within the local community.
- Achieving Sustainability: The Workshops had to prove their worth and garner local support in such a way that they would be sustainable at the end of the grant.

In the following sections of this report we discuss the nature of the CSW achievements in each of these areas.

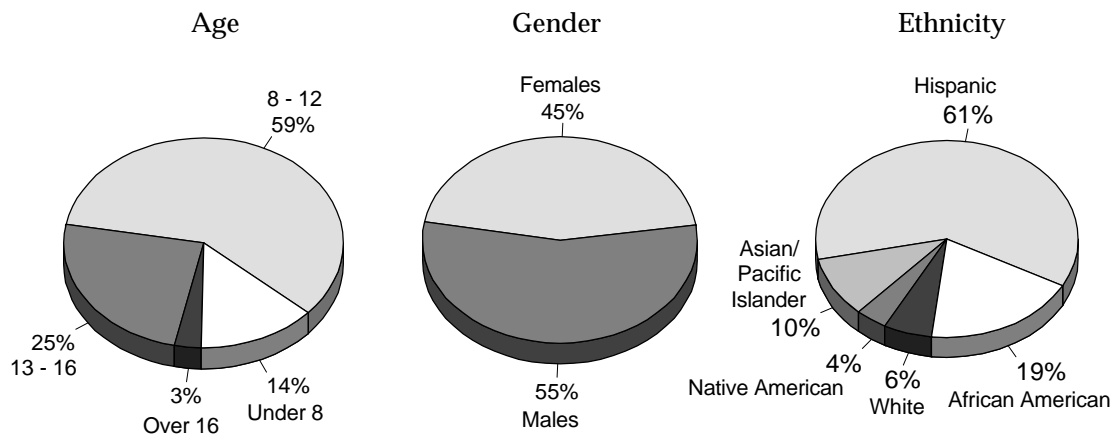
Serving the Youth of the Community

- The CSWs Have Succeeded in Attracting the Participants They Aim to Serve

One of the major goals of every Community Science Workshop is to serve youth who traditionally have not had similar opportunities to be involved with engaging after-school programs in easily accessible, welcoming settings. As we studied the CSWs we learned that they accomplished their mission well.

Each of the eight new CSWs, like their parent the Mission Science Workshop, is located in the immediate neighborhood of the children it aims to serve. Children generally do not have to be bused or driven to participate in CSW activities; rather, they merely walk down the street. More importantly, the Workshops serve neighborhoods, and the youth who live in them, which suffer from a dearth of positive alternatives. In fact the alternatives that are available in these often impoverished environments are frequently dangerous.

FIGURE 1. A PROFILE OF CSW STUDENT PARTICIPANTS



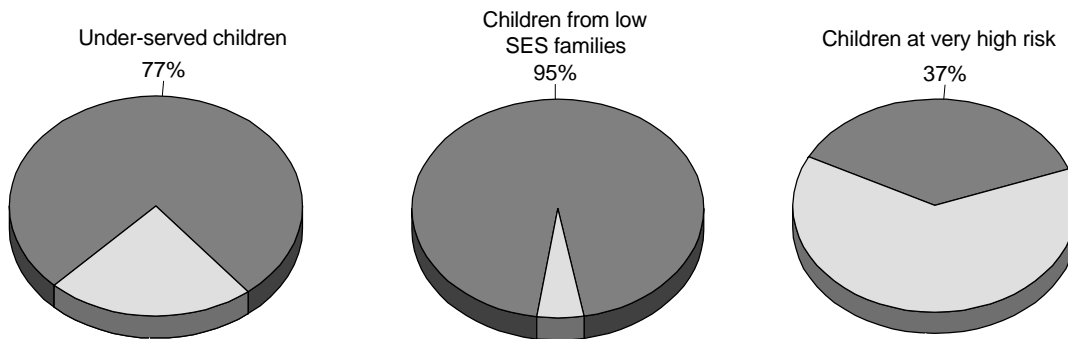
We learned from surveying the sites that the “typical” CSW participant is an Hispanic boy or girl between eight and 12 years old. As children in the early and middle elementary grades they are getting too old for baby sitters, but are still too young to be unsupervised when not in school. However the programs also draw significant numbers of older and younger participants, as can be seen from the graph above. Twenty-five percent are 13 to 16 years old, and 14% are under eight years old.

We were surprised to learn that, contrary to what we expected to find, the CSWs appeal to boys and girls fairly equally. Overall, the CSW participants are 55%

male and 45% female. As we have mentioned, a number of the site directors have made special efforts to attract girls to their Workshops (e.g., by having female staff, scientists, and artists run special activities at regularly scheduled times, or having “girls” clubs at times when only girls were allowed in the Workshop). This attention to the issue of attracting girls to the program, we think, has likely contributed to the stronger than expected female participation.

While Hispanic participants are in the majority (61%), we learned that CSW programs attract a rainbow of students: 19% African American, 10% Asian or Pacific Islander, 4% Native American, and 6% white.

FIGURE 2. PERCENTAGE OF HIGH-NEEDS CHILDREN AMONG PARTICIPANTS AT CSW WORKSHOPS



We learned from our survey of the sites that without a doubt the CSWs are not just another after-school activity for children with lives rich in extra-curricular activities. Rather the CSWs serve exactly those children they hope to attract. We learned that the large majority of participants who attend the Workshops have few to no opportunities to attend organized, productive, interesting after-school or summer activities. The majority come from low SES families, and many are considered at risk of entering the juvenile justice system.

- 77% of the youth served by CSWs are classified as “under-served.”
- According to estimates by the site directors, 95% of the participants are from lower socio-economic families.
- 37% are seen as being at very high risk of entering the juvenile justice system.

As we interviewed CSW directors many of them told us that often the youth who participate – and in fact, who often excel in a CSW setting – are those youth who have no place to go after school. Moreover, many of the young people who attend have not been successful in traditional school settings, but find a great deal of engagement at the Workshops. This is in part because the CSW activities are particularly well-matched to the needs, interests, and learning styles of these boys and girls. Focusing on the practical, the interactive and the common-sensical, rather than on traditional paper and pencil activities, CSW “work” allows the youngster who is not academically inclined, but who is inquisitive and intelligent, to channel his or her energy into stimulating projects and activities of their own choosing. A site director told us:

One of the most fulfilling things for me is working with the kids who don't do well in school but who excel at the Workshop. Like these two boys, Jan and Skyler. Those two excel at all the projects in the Workshop, but they are failing all their classes. I think school isn't challenging enough for them. The Workshop gives them something new.

Another site director explained how at his Workshop they make efforts to be inclusive of gang members in the neighborhood:

We have a lot of gang kids in our program. We don't say no to the gangs because our program is probably one of the few in the city that doesn't just b.s.... We mean it, we want those kids in our programs. A lot of programs say they want them, but they don't really want them. My thing is [that] you have to get them busy and occupied and then they start getting involved with positive kids. Instead of throwing them out, we let them come in...

- The CSWs Have Created Programs That are Valued by the Young People They Serve

The CSWs have succeeded not only in creating places where minority and under-served youth are motivated to go, but in creating an experience that these youth value. When we visited sites as part of our documentation of the CSW initiative, we always interviewed student participants. Overall we learned that CSW participants value having a safe place to be after school and on weekends. They value the rich and interesting array of projects and activities that are offered to them at the Workshops. They also, although they would not have used just these exact words, value the *culture* the Workshops create – a kind of sanctuary in which they can be with friends and the other youth who participate in the Workshop programs, and most importantly the positive relationships they are able to have with adults.

SAFETY AND ENGAGEMENT

For most of the youth that attend programs at CSWs, there are few or no other structured activities for them to participate in after school on a regular basis, and certainly nothing with a science focus. In our interviews with youth the boys and girls reported that no other comparable activities are available to them in their communities. Most other alternatives, such as Boys and Girls Clubs, and Parks and Recreation programs, are centered on sports. Indeed, most of the youth see their options as playing sports (either organized or on the street with friends), or watching television at home.

The CSWs have succeeded in providing youth with a safe haven where they can get involved in interesting, science-related activities and opportunities on a regular basis, taking advantage of a chance to engage in activities that are unlike any others in their daily lives. As one youth said when comparing his CSW with a local youth center:

[At the youth center] they don't make stuff like we do here, and they don't have "classes" every day.

As another youth stated:

[The Workshop] is fun. I don't get in trouble here and it is a place to learn.

SCIENCE-ORIENTED PROJECTS

We learned that youth are almost unanimous in their praise of the projects and activities at the Workshops. "Making things" is almost always mentioned as what they like best about coming to the Workshops. At every CSW we have visited there are an infinite variety of things that youth can work on, limited only by available materials and imagination. As such, simply working on and completing a project by themselves is important to the children, and something that makes their experiences at the Workshop meaningful and unique. In this sense, "making something," and, importantly, finishing it, is therapeutic for many of these youngsters.

A 12 year old African American boy with whom we spoke – who was attending continuation school because of persistent behavioral problems, and who, from our brief acquaintance with him we would characterize as hungry for attention – had been attending a CSW site for almost two and a half years. He expressed pride in working with tools and creating a magnet pendulum all by himself. He told us proudly: "I didn't need no help."

A 14 year old African American male described his Community Science Workshop in the following way:

It's a place for science, hanging with friends, doing art, and working with wood... You get to do a lot of things at once, [there are] a variety of things to do. [There are] different people to help you with projects.

A 10 year old boy was working on creating a downhill ramp with three different surfaces to run his cars down, to see which surface allowed the car to go the fastest. He made "a neat discovery" when he mounted an entry/starting point on his ramp. To create the starting point, he drilled two holes in the ramp and stuck dowels of the same length through the holes. He found that the dowels served both as the marker for starting and they created a way to adjust the incline of the ramp because the top of the ramp now rested on the dowels. He found he could move the ramp up the dowels to increase the incline and lower it to decrease the incline.

At several of the Workshops, aquaria filled with snakes, hamsters and fish are part of the array of interesting resources available to youth. Watching the snakes feed on mice is an especially captivating activity that usually brings other projects in the Workshops to a halt. On a given day at most of the Workshops, participants assist in feeding and handling the menagerie of living creatures.

The living things contribute to the ambiance and vitality of the Workshops. For example, the pet rabbit is allowed to hop around Brookdale Discovery Center during program hours. In another instance, hamsters were the focus of a long-term project for a number of participants who got to take baby hamsters home. Children built cages for them and monitored their eating habits over time as well as brought them back to the Workshop periodically to ensure their proper care.

Many of the participants, who have grown up in urban environments and who aren't allowed to have pets at home, are intrigued by the animals. For them other living creatures are a novelty and make a deep impression. As one young participant said:

I [like to] play with the snakes and look at the animals...I can't have animals at home... The landlord don't want us to... Nonny (grandmother) had a bird, two birds... Then the landlord said, "You can't have no pets here."

Just as zoos are homes for endangered species, we began to see the CSWs as homes for endangered experiences. That is, many of the experiences that young people used to take for granted as they were growing up are now very

constrained or even eliminated by the harshness of urban life. The CSWs, with their resources and caring adults, are providing some of that missing enrichment.

RELATIONSHIPS

For some youth, attending the Workshop with friends is an important part of their experience. For others, the value comes in finding peers at the Workshops who are different from the youth they know “outside” of the Workshops. For example, one twelve year old boy said that he would never bring his peers to the Workshop because “they’re traitors.” He thinks of the Workshop as his own place, a kind of ‘alternative culture,’ and as such wants to protect it from those friends of his who would not appreciate it.

At all sites, in addition to interacting with other youth, participants interact with the adults who lead and volunteer at the Workshop sites. In many of our interviews young boys and girls told us about how they value the relationship that they have with the site directors and the other volunteers who work at the sites. As one youth stated:

If I am doing something wrong, they will come over and tell me what I’m doing wrong, or how to use the tool correctly. Like when I was using the saw the other day, I didn’t know how to use it right and it kept jerking and I messed up my wood and I had to start all over again. And Mr. Gray came and told me that if I just make a little mark on top of it again, you can just go back and forth.... I feel kind of glad [when he tells me I have not done something right], because then I know how to do it next time, and then next time I can show somebody else how to do it and then do it even better.

In general, at all sites, youth like the staff. They find them kind, helpful, positive and supportive. An African American girl at one site said that the staff are like good friends who help her with projects and help her find things she needs in making her projects. As an example of the kinds of special efforts taken on behalf of the youth, the director has helped connect the girl, who is interested in a medical career, with a female biologist who does dissections at the Workshop on weekends.

At a few of the sites, the directors may be the only white males many of these youth have interacted with informally and over an extended period of time. These interactions can contrast quite dramatically with other relationships the youth have with other adults in their lives. As one youth stated about the site director at the CSW he goes to:

He is fair to the other kids and me. He helps us a lot [to] do science. He helps me get out of trouble [by saying] “cool down.”

Another youth said that the site director was nice to him (a rare experience for him to have a positive relationship with an adult) and fun (in contrast to his teachers). “You know how teachers are.”

I learned how to keep my temper down because if you make something and don't like it and want to break it, the [site director] says, “Try again, try again.”

Designing Programs

The CSWs sought to replicate the success of the Mission Science Workshop in terms of its ability to offer a variety of programs that could serve many local youth as well as other audiences. In this section we describe the extent to which the CSWs, to date, have been able to achieve this goal.

- The “Typical CSW Site”

The approach and programs of each Workshop is very much dependent upon the vision of its director and the milieu within which it operates. Also, as we will explain more fully later on, the Workshops tend to grow over time so that mature sites are quite different than new sites in terms of the scale and diversity of their offerings.

PARTICIPATION PATTERNS

Even though there is no typical CSW site we can present the averages⁷ of our data to give the reader some sense of the scale of the work of these CSW sites. We can say that on an annual basis⁸ the “average” CSW site serves 154 participants each year through a menu of four different programs. Of those participants:

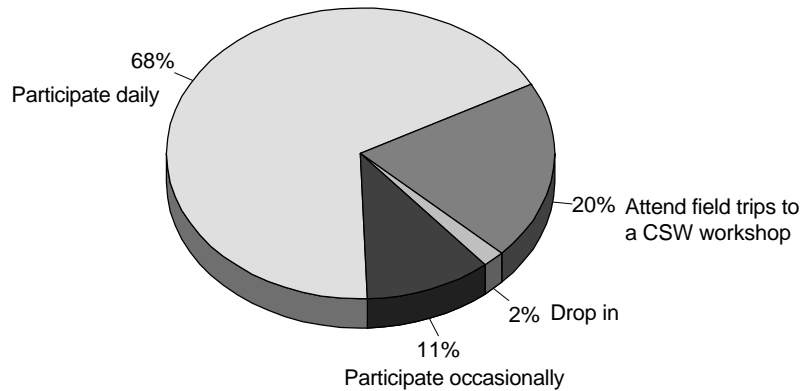
- An estimated 68% attend nearly every day the program is offered, and another 20% participate on a more occasional basis.
- Thirty students visit the typical Workshop on field trips.

⁷ Throughout this report, when we indicate that a figure is a “typical” or “average,” we have calculated the arithmetic mean (i.e., added data for all eight sites and divided by eight). This is an appropriate approach for profiling a program like CSW that has a relatively small number of sites; however, it is important to remember that the average does not represent any single program. Please see section I in Appendix B – Technical notes and comments on CSW data collection and reporting – for a more detailed explanation.

⁸ Our data represent the CSWs from June 1998 through June 1999.

The majority of participants (68%) come to the Workshops daily. This does not, however, mean that this is a consistent group of the same youth over time. The group of “regulars” slightly changes composition every few months when new youth discover the Workshop and others drift away. Figure 3 below shows the participation patterns for youth in the CSW programs.

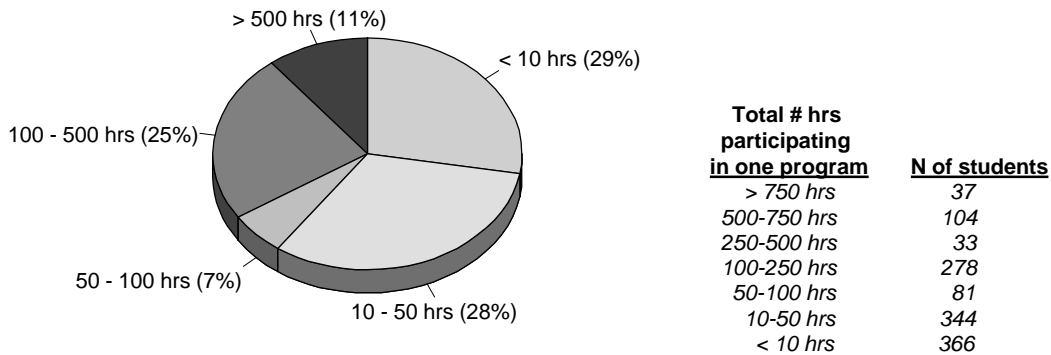
FIGURE 3. PATTERNS OF STUDENT PARTICIPATION IN CSW PROGRAMS



We believe it is important to note that the CSWs provide a kind of “home” for many of its participants. The youth who choose to come to a CSW most often develop long-term relationships with the site. Almost half (43%) of the youth served by the CSWs participate in at least 50 hours or more in a year, and more than one-third (36%) participate for 100 hours or more. Less than one-third (29%) participate in a CSW activity for ten hours or less each year.

Also, many youth stay with the Workshop site for multiple years; Figure 4 below shows the total hours that youth participate in CSW programs.

FIGURE 4. HOURS OF STUDENT PARTICIPATION IN CSW PROGRAMS



Note that a student who participates in more than one program is counted as a participant in each program he or she attends.

PROGRAM OFFERINGS

The CSWs offer many different kinds of programs. For the purpose of our analysis we have categorized them into four types:

- Drop-in programs provide the opportunity for youth to come on their own accord during regularly scheduled times, when they can work on their own projects. These programs are offered both during the school year and sometimes in the summer, depending on the site.
- Special focus programs have a set theme or one project that all participants work on at the same time (like dissection sessions, or robots, or a creek water analysis project).
- Outreach programs are when CSW staff go into the community (to schools, Park and Recreation centers, etc.), and conduct hands-on science and art programs there.
- Field trip programs are provided for schools groups and their teachers visiting the Workshops.

In Figure 5 below, we depict an average CSW site in terms of these four types of programs and the number of participants attending each different type.⁹

FIGURE 5. THE "AVERAGE" CSW WORKSHOP

	Drop-in programs	Special focus programs	Outreach programs	Field trips to CSW Workshop
Number of students attending the average program of this type each day they operate	27	18	50 ¹⁰	48
Average number of weeks in each year the programs of this type operate	35	13	14	NA
Average number of hours per week the average program operates	14	10	3	NA
Average total hours each program operates each year	413	72	53	10
Estimated annual participant contact hours for each program	8,971	1,796	1,730	414

The data presented above make it clear that the primary program offered at each of the Community Science Workshop sites is the drop-in program. These programs generally run anywhere from two to five nights a week in the late afternoon and early evening. Participants come after school and either begin work on a new project, or continue work on a project begun on a previous night.

In addition, several sites have offered summer programs for local youth. At some of the Workshop sites, summer programs are extensions of the drop-in program run during the school year. At other sites, summer programs are separate programs serving additional youth, or may include programs with special foci. For example, in Los Angeles, the 32nd Street Workshop site served as the science component for several hundred middle to high school students who were participating in an NCAA-sponsored summer enrichment program. At Brookdale, special summer Workshops have included a creek water analysis project, sponsored by the Environmental Protection Agency. In addition, Fresno and San Bruno have also offered special "girls' club" programs – afternoons or evenings where the Workshop was only open to girls – in an effort to increase participation by females in CSW programs.

⁹ In interpreting the numbers, it is important to note that although the average number of participants in a drop-in program is 27 compared to 48 in field trips to the Workshop, an average drop-in program serves participants many more hours than does a field trip program. The drop-in program is the backbone of the CSW programming.

¹⁰ Two programs reach large numbers of students (53 and 135 students); three involve 20 students each.

TOTAL CSW PROGRAM PARTICIPATION

Aggregating all of the CSW data we are able to present a picture of the collective program offerings and youth participation rates for all the CSWs. Figure 6 below shows the total number of programs offered and participants in each for the past year:¹¹

FIGURE 6. COLLECTIVE DATA FOR 1998-99 CSW PROGRAMS

	Drop-in programs	Special focus programs at the sites	Outreach programs	Field trips to CSW Workshops	Total CSW programs for children and youth ¹²
Total Number of Programs Offered	16	7	5	5	33
Illustrative examples	After school, summer programs	Gardening, animal dissection	Director visits a classroom	15 elementary students visited Workshop for 4 hours	
Number of sites sponsoring one or more programs of this type	8	2	3	4	8
Time of year the programs are offered	School year (10), Year round Summer	Summer, School year	School year	School year	Year round
Estimated total participants per year	484	153	355	240	1,232
Total program hours per year	6609	499	263	52	7,423
Total participant contact hours per year (est.) ¹³	176,606	5,135	8650	2,070 ¹⁴	192,461

¹¹ In addition to the total number of CSW programs for children and youth as shown in Figure 6, several CSW sites also sponsored programs for teachers and Parks and Recreations staff. A total of 67 teachers spent a half to a full day at the Workshops and seven Parks and Recreation program directors attended a two-day training. The Capuchino High School Workshop site in San Bruno offered summer workshops for teachers, which focused on enriching teachers' science content, and allowing teachers to build exhibits for their classrooms in the Workshop. Site directors at Fresno and Watsonville have also spent a great deal of time in schools doing science activities with teachers and students.

¹² As noted earlier, CSW sites also sponsored four programs for teachers and Parks and Recreation staff, for a total of 37 programs.

¹³ Estimated by multiplying the number of program hours times the estimated number of students attending daily (100% of program hours) and occasionally (counted as participating 40% of the time). One time drop-ins were excluded from these calculations.

¹⁴ Over 1/2 of these hours were offered in Fresno; half the students were at San Jose.

- Levels of Site Development

A very important aspect of the Community Science Workshops is that they develop increased capacity over time. That is, the Workshops grow themselves by developing the skills of existing staff, hiring new staff, and by becoming smarter about their program designs. In this way Workshops behave like successful small companies, which also grow their capacities for doing work and for producing products in greater quantity and with ever-increasing quality.

We were able to categorize the Workshops into two rough groupings based on their maturity and growth. We defined “fully developed” Workshop sites to be ones that are fully functioning at the end of the three years of CSW funding and have secured funding to sustain the Workshops indefinitely. All the others we defined as “still developing.”

If we compare the three “fully developed” sites¹⁵ which have operated for at least three years to the five sites that are still developing, we see that as sites have become fully developed, their capacity to offer multiple programs has also increased. While the “fully developed” sites represent only 37% of all CSW sites (by the end of our study), they account for 52% of all programs offered.

FIGURE 7. PERCENTAGE OF PROGRAMS OFFERED BY DEVELOPING AND FULLY DEVELOPED SITES

	Total number of sites	% of all sites	% of all programs offered
Developing CSW sites	5	63%	48%
Fully developed CSW sites	3	37%	52%
All 8 CSW sites	8	100%	100%

For a more detailed picture of what a “fully developed” site looks like, Figure 8 below shows a comparison of “developing” and “fully developed” sites along several other dimensions. The figures suggest that as sites become fully developed, they offer on average more programs – 5.7 programs compared to an average of 3.2 programs for the developing sites, and more participants hours – 273 hours of participant activities over the year compared to 191 hours at developing sites. Finally, the three fully developed sites provide for nearly three times as many contact hours as the other five sites combined.

¹⁵ These include Brookdale, Fresno and Los Angeles.

FIGURE 8. A COMPARISON OF DEVELOPING AND FULLY DEVELOPED CSW SITES

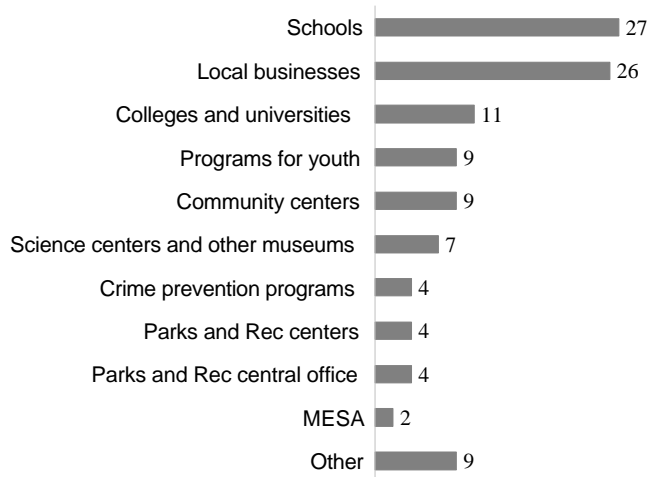
	Developing sites	Fully developed sites	Total sites
Number of sites	5	3	8
Total number of programs offered	16	17	33
Average number of programs per site	3.2	5.7	4.1
Average site program hours per year	191	273	222
Estimated total # of student participants at these sites	634	598	1,232
N of students attending the average activity each day it operates	38	34	35
Total site participant contact hours	14,392	40,166	24,058

Connecting With the Community

- The CSWs Have Made Connections With Business, Schools and Other Institutions

An important expectation from the outset of this initiative was that the CSWs would serve the interests and the needs of their surrounding community. A large part of their development work has been to create community linkages which could serve multiple purposes. Through connections with existing institutions, agencies, and programs the CSWs and their work have become known and valued in the broader community. Particularly when symbiotic and collaborative relationships were established, these linkages proved to be mutually beneficial. For instance, linkages with universities have met a need of the CSWs by providing student assistants as part-time staff. At the same time, the CSWs have offered interesting job opportunities to the university work-study programs where students can learn important life and job skills.

FIGURE 9. ORGANIZATIONS THAT PLAYED ROLES AT CSW SITES IN 1998 - 99



As one can see from the preceding graph we learned that the CSW sites developed a surprisingly rich array of relationships and connections with other organizations in their community. Most of the community links CSWs forged were with schools and local businesses. There are 27 CSW relationships with schools, and 26 that have been developed with businesses. The average number of community linkages for an individual CSW site is 14.

Thus, in our fictitious “typical CSW site” we would find 14 community linkages which would include the following types of institutions and organizations:

- 3 to 4 schools and 3 to 4 businesses
- 1 to 2 junior colleges and/or universities
- 1 science center or other museum, 1 program for youth, and 1 other community center
- Another 2 to 3 Parks and Recreation centers, crime prevention programs, MESA, and/or other organizations and programs supportive of the Workshop.

However, we also learned that sites actually vary significantly in the degree to which they are “well-networked.” Three of the eight Workshops had few linkages (2 to 4), while two sites had established connections with 14 other programs, institutions and organizations. The three “well-networked” CSW sites had built from 23 to 26 linkages with community entities.

- The CSWs Are Valued By Individual Members of Their Communities

As the Community Science Workshops established community linkages to various organizations in their immediate communities they gained the gratitude and respect of the individuals with whom they worked. Parents, educators, and community members we interviewed appreciated the value of the programs provided by the CSWs.

The two most frequent comments that we heard were that the CSWs offer youth a unique learning experience and a safe environment. Community members see the CSWs as places where children have supervised, productive activities to engage in after school. They value the student-centered nature of the Workshops and the opportunities for informal science learning. We heard anecdotes from parents who told us how their children, who had been failing in school, were “turned around” by their experiences at the Workshops.

Similar to the boys and girls we interviewed, community members told us that in their view, much of the value of the Workshops comes from the free choice and independence the youth are allowed, particularly in the choice about what project they will work on. One mother told us:

[What I like about the program is that] there's some freedom of choice, there are different programs; it is not too structured like school is...

Parents in particular also see value in the fact that youth emerge with a product to show people – something physical that they can show their parents, friends and teachers at school. A mother of a participant noted:

They like to come here because they can create. They show their projects in class and with their cousins. They love it and don't want to leave.

Another mother told us how their entire family engaged in activities because of the Workshop. She explained that she and her kids play at home on the weekends with the projects they made at the Workshop. This in turn led this mother to borrowing books from the library and calling the site director for ideas. She told us, “[The kids] raised questions about how they could change the projects or alter them.” The family then brought the projects back to the Workshop, continuing to work on them, and making the changes that incorporated the children’s ideas for alterations.

Although the parents who come to the Workshops have quite positive impressions, the percentage of parents who actually spend much time at the Workshops is quite small. When parents do come, it is frequently on nights

when the Workshops stay open late and parents are able to join their children after work. Because of the socio-economic situation of many of the families served by the Workshops, youth participants often go to the Workshop when their adult caretakers are not home. As a result, the youth themselves are the primary source for parental impressions of the CSWs.

Other adults such as teachers and community members, however, can be counted among the group of supporters who value the Workshop experiences for youth. As one teacher who brings students to one site for family nights said:

[The Workshop] is providing the community a safe environment for varied activities, not textbook science. It goes beyond the text – to the actual physics of it. The kids ask adults for help because they are interested and want to succeed.

An administrator in the Los Angeles Unified School District, who oversees elementary, middle and high schools in a 24 square mile area of the city, is a strong and politically savvy supporter of the Los Angeles site. Many of the schools in this area are counted among the neediest in Los Angeles. (In fact, John Muir Middle School, host to a CSW program, was identified as one of the 100 worst schools by the Superintendent.) This administrator has been instrumental in linking the CSW programming with the rest of the district, as well as making connections for them with other funding sources, and had this to say about the strengths of the Workshop:

We know [the LA] CSW is supervised – so we educators can count on the kids being ok there – and so can the kids.... If a program is mandated, it is like school... but if the kids can experience small successes, they learn to stick with it.... It helps kids develop a thirst for knowing something without anyone telling them they have to do it... this exemplifies the discovery approach to learning.

The assistant principal at John Muir Middle School talked about the Workshop's value in terms of hands-on science, but also its value to the community in providing a safe, after-school activity for youth:

...the CSW is voluntary, hands-on, a place where kids are actually doing things. The adults are getting excited; teachers can use this to create [student] interest.... [These] kids are hostages in their own homes; if they're good kids, they are told: 'Don't go out.' [At CSW] they have supervised activities; they are safe; they can follow their own interests. They start out with drill teams, and sports... later they might go to the CSW, and maybe discover a talent and interest they didn't know they had.

The assistant principal at 32nd Street School, another school that hosts the LA program, said:

CSW fits perfectly with our goals for our students, in that it connects arts and sciences... All our students should go through [the experience it offers]... The parents send their kids because it's safe.

Still another example is at the San Bruno site where girls from the Latina Mentor Program participate at the Workshop. The head of the math department at Capuchino High School and a mentor in the Latina Mentor Program noted:

The girls come from families where they are asked to do a lot of things at home [i.e., fulfill traditionally female roles] ...there are not many books or magazines. The Workshop is up there [in terms of the experiences they are getting] because they can make something and take it home and say, "Look what I made." And it is educational. They show their parents the value of what they've been doing.

Thus, in these various ways, we learned that the Community Science Workshops are not only unique programs serving youth by offering them informal science learning experiences, but also have developed and today can claim a broad base of community support from youth and adults alike.

Achieving Sustainability

The Workshops have had to prove their worth and garner local support, displaying that they could sustain this program through and beyond the end of the funding period. The following sections detail the way the Workshops are achieving, or hope to achieve, sustainability.

- Staffing

The "typical" CSW site is staffed by a director and one or two other paid staff. They work nearly 40 hours per week of which approximately 25% is unpaid time. The total cost of staffing at the average site is \$47,450 per year, of which \$40,274 goes to core staff and \$6,279 goes to paid assistants. In addition many sites get help from volunteers.

- Total Revenues and Expenditures

The hypothetical "average" CSW site:

- Received \$50,623 in direct funding and \$26,519 of in-kind contributions for a total budget of \$77,142 annually.
- Received NSF funding of \$19, 769.

- Received support from other grants averaging \$17,950, supplemented by an additional \$1,819 of in-kind support (mostly in the form of supplies and equipment from MSW, and from other CSW sites and supportive institutions like the Exploratorium).

COST-EFFECTIVENESS

Not only do the CSWs provide under-served youth with rich alternatives to an otherwise limited array of extracurricular opportunities, but they do so in a cost-effective way.

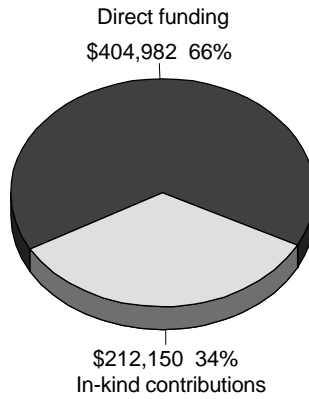
- The total cost for each hour of CSW program activities averages \$84 per hour. Of this the cost to NSF is \$22, or about 25% of the total. The low cost to NSF reflects the fact that CSW programs attract about \$3 from other sources for every \$1 of NSF funding.
- The cost per youth participant per year is estimated to be \$500 on average; the cost to NSF per participant is about \$128.
- The CSW programs require a very small NSF investment per student participant hour. We estimate the total cost per participant hour to be about \$3.20.¹⁶ NSF contributes about 83 cents of the total cost per hour.

MULTIPLE SOURCES OF SUPPORT

As Figure 10 below shows, the eight CSW sites collectively received a total of \$617,132 annually (in the fourth year of NSF funding). Two-thirds of the support was in direct funding (\$404,982), and the remaining one-third (\$212,150) was in the form of in-kind contributions (e.g., materials and equipment, space, insurance, interns support).

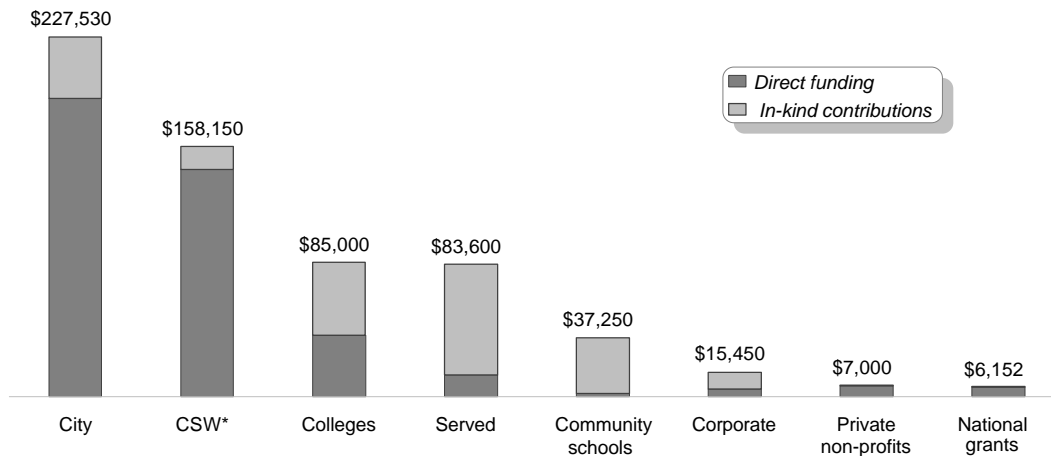
¹⁶ This compares with a cost of approximately \$6 per student participant hour for the cost of school instruction.

FIGURE 10. DIRECT FUNDING AND OTHER SUPPORT FOR CSW



The CSWs have been successful in garnering financial support from their host cities, nearby colleges and universities, and local schools. Figure 11 below shows the level of support from different sources (in the fourth year of the NSF grant).

FIGURE 11. TOTAL CONTRIBUTIONS BY CSW SUPPORTERS

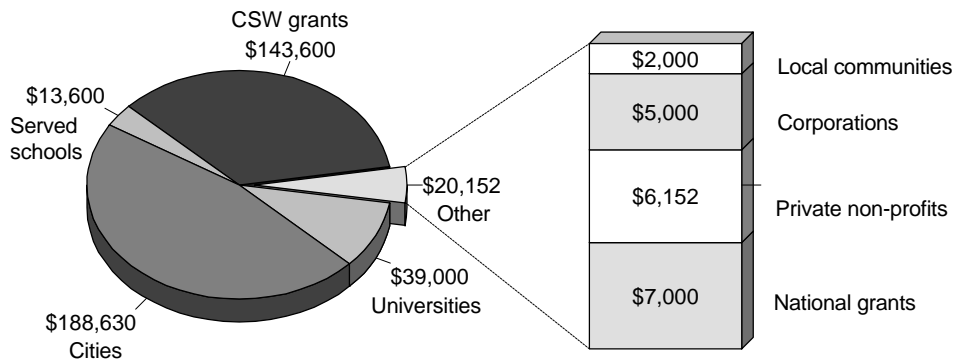


* During the profiled year, five sites received CSW grants ranging between \$23,000 and \$32,000. Four developing sites also received between \$400 and \$5,250 in in-kind support from MSW, and from other fully developed CSWs and other supportive institutions.

The largest sources of support (in the fourth year of the NSF grant) were city grants and contracts (\$188,630, or 47% of the total funding). NSF was second in its support, funding 36% (\$143,600) of the total revenue the CSWs received. The remaining \$72,752 was contributed by a variety of local agencies and other supporters.

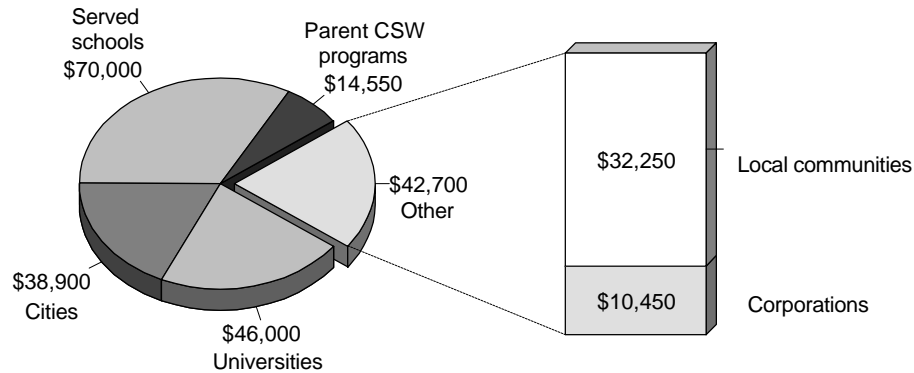
Figure 12 below shows a detailed breakout of the other sources of funding for the CSW sites.

FIGURE 12. SOURCES OF ANNUAL DIRECT FUNDING FOR CSW SITES



Schools served by the CSW programs contributed one-third (\$70,000) of the total \$212,150 of in-kind support for the sites. Other major sources of in-kind support were universities, cities, and local community agencies and organizations.

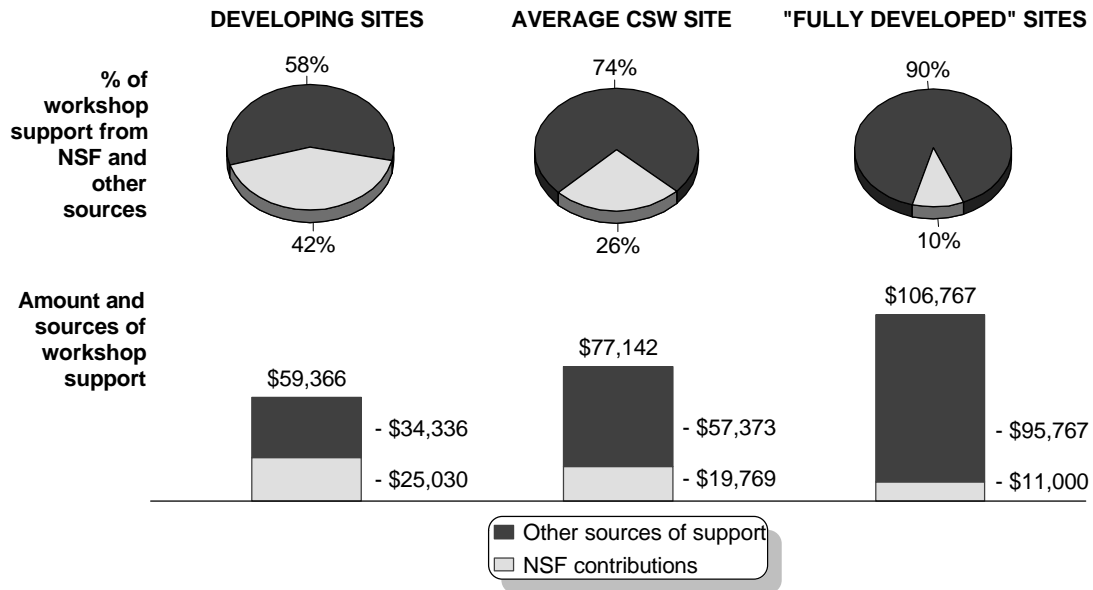
FIGURE 13. SOURCES OF ANNUAL IN-KIND SUPPORT FOR CSW SITES



- The Developmental Level of Sites

In an earlier section we described how the three most mature and “fully developed” CSW sites are able to provide a large majority of the services offered by all the CSWs. In a similar way we have found that the CSWs become more cost-effective as they grow and develop their capacity. Three of the eight sites matured considerably in their second to third years of operation. These sites – Brookdale, Fresno, and Los Angeles – were considered fully developed sites by June 1999. This does not mean that they will not continue to develop and expand further, but rather that they had successfully secured enough funding to sustain their work with little or no support from NSF. These three sites illustrate how CSW dependence on NSF funding declines as the sites grow and are able to attract increased financial and in-kind support from other sources. Figure 14 presents a comparison of sources and amounts of annual support by level of site development.

FIGURE 14. COMPARISON OF SOURCES AND AMOUNTS OF ANNUAL SUPPORT FOR THE AVERAGE SITE (BY LEVEL OF SITE DEVELOPMENT)



Data for three sites – Brookdale, Fresno and Los Angeles – were averaged to calculate "fully developed" site figures. Averages for the other five sites provided "developing sites" figures. Figures from all eight sites were averaged for the middle figures.

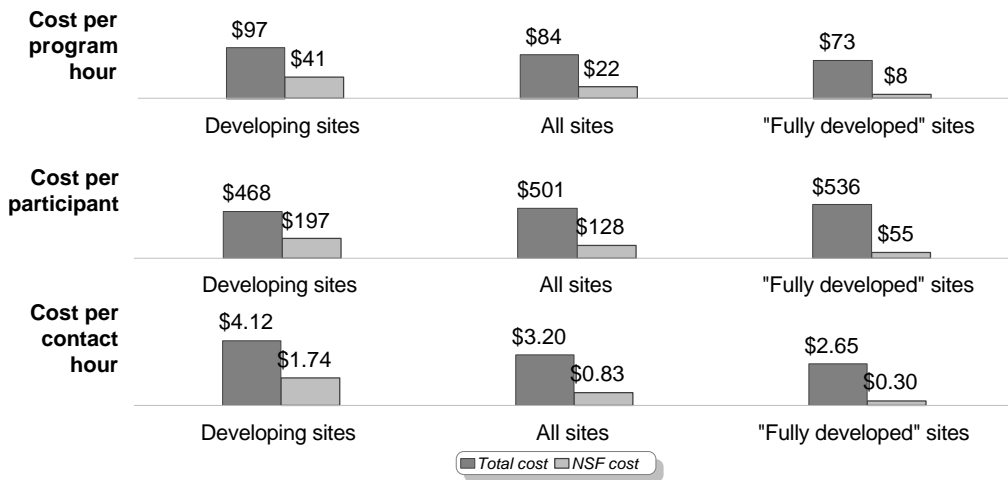
The implications of the funding pattern shown in these graphs is most important as it shows that NSF investment is truly leading to institutionalization and sustainability. The increased amount of work done by the more mature sites combined with the fact that they are gathering revenue from multiple sources means greatly increased leverage of the NSF funds. In the data shown in the tables below, one can see that:

- Fully developed CSW sites cost NSF less than one-fifth as much as developing sites per program hour provided.
- Fully developed sites cost NSF about one quarter as much as developing sites per participant served.

Developing, fully developed sites, and the hypothetical "average" site are compared in the graph below by costs per program hour, per participant, and per contact hour.

We feel it is important to emphasize the significance of this data. It shows clearly that the CSW sites are capable of growing their own capacity to do increasing amounts of work. It shows that they are also capable of garnering increasing amounts of local support as they grow their programs. The combined effect of doing more work with greater and greater portions of that work funded by local sources means that the CSW sites are, in fact, becoming institutionalized. While many projects that NSF funds promise to develop sustainability, this is one of the very few projects that we have encountered that has demonstrably achieved that goal.

FIGURE 15. COST TO NSF AND OTHER FUNDERS PER PROGRAM HOUR, PARTICIPANT AND CONTACT HOUR (BY LEVEL OF SITE DEVELOPMENT)



IV. THE KEY LESSONS LEARNED TO DATE ABOUT DEVELOPING COMMUNITY SCIENCE WORKSHOPS

As the Community Science Workshop sites throughout California have become established and evolved through their first years, several key lessons have emerged. We include a discussion of these lessons here, so that those who are interested in replicating the CSW model can be advised of the issues that are critical to consider. In addition, we hope that a frank discussion of the lessons learned will support the current CSW network in a process of self-reflection and self-assessment, which in turn might ultimately contribute to the long-term success of the individual sites.

The Selection of the Leaders

By studying the CSW initiative over the past five years we have learned that one of the most important factors in the success of the Community Science Workshops has been the quality of the leadership – and, in particular, the quality of the Workshop director. As we have previously mentioned, Mission Science Workshop staff paid very careful attention to finding just the right people to direct the sites early on in their development. This is not an easy task. Good directors are excited about doing science; they are tinkerers by nature; they must work well with and be able to inspire the youth, and, sometimes most difficult, they must be able to manage the sites and community connections that are needed to sustain the sites. In the words of one of the directors, they “must be good on their knees working with a child who is fixing a motor, and also wearing a suit and meeting with local city officials.” Hence, Workshop directors need to have skills that include scientific expertise, administrative acumen, teaching ability, community organizing, mechanical ability, a penchant for tinkering, and, most importantly a deep commitment to providing successful experiences for under-served youth.

The vignette below is the story of only one of the CSW site directors, but it is representative of the group in the sense that each site director has as rich a personal background as the one described here. In all cases, the site director’s background and own personal history tend to strongly shape the overall commitment to the work.

The Workshop Director

Manuel Hernandez, the Fresno CSW site director, was born in an East Los Angeles barrio and as early as seven years old was hanging around gangs. As a youth, he felt “ripped off by schools” and became increasingly involved in gang activity and its violent culture. This came to crisis when he was 16 and ended up in the hospital from injuries received through street violence. Soon thereafter, he was lucky enough to meet an older man who counseled him: “Manuel, you are too smart to be on the streets.” This ‘mentor’ got him a job in a lumber yard.

This proved to be Manuel’s turning point. He went on to learn many trades, always increasing his skill and experience. He is now married with three children and works as an electrician in the Fresno area. As a result of his own personal knowledge of being a kid on the streets – “I have seen so much bad stuff” – he is now deeply involved in his community on many levels. Besides his regular job, he also lends his skills as an electrician, landscaper and plumber to the Home Builders’ Association, a group formed from the local churches which raise money to fix old homes to provide low-income housing. He is also the local site director of the Fresno CSW. He wants the kids to make a connection between the Workshop and real-life, and as a result he will often take the kids, including his 12 year old, Chris, on impromptu “fieldtrips” to the current house he is repairing for the Home Builder’s Association and involve the kids in the work he is doing.

The way Manuel became a CSW site director is illustrative of the personal approach MSW staff takes in finding and recruiting site directors. Manuel was volunteering at the Chicano Youth Center in Fresno when a community leader brought a group from MSW to see the site and determine if it was an appropriate space for a science workshop. Manuel realized “no one was [there] to tell them anything about it” so he began to show them around the Center. Dan, the head of MSW, had apparently heard about Manuel and asked him some questions about his community service and other work, as well as his hands-on experience working with different tools. While Manuel wasn’t sure what Dan’s interest was about, he showed him some of his own tools he’d brought to the Chicano Youth Center and told Dan about the work he’d done in the area. Later, Dan told Manuel “You are the guy I am looking for,” and explained that he would like Manuel to be the site director for a CSW in Fresno. Manuel accepted: “I liked it because it was going to be hands-on. This is what I have been doing and I like doing it.”

Across all of the sites, the directors have very different strengths and qualities. However they do share some characteristics in common. First and foremost, they are advocates and activists for the youth. They believe passionately that providing positive experiences for neighborhood youth is the most important part of their job.

Secondly, they are “tinkerers.” They like to learn for themselves in the same ways that the children they are working with like to learn – through playing and experimenting with materials. They like to take apart and build things to see what kind of meaning they can make of them, which makes them ideally suited to create similar activities for youth.

Third, many of the site directors come from backgrounds that make them very accessible to the youth. Two of the site directors are former gang members, so they can personally understand the need for creating safe havens in the neighborhoods for youth. Most of the site directors are minorities. Also, several

of the site directors live in the neighborhoods in which the CSWs are housed. They know well the youth, the problems and the lack of opportunities young people face.

The Support of the Leaders

In addition to the initial selection of the directors, another important lesson we have learned from the project is that it is key to provide support to the site directors throughout the whole process of developing a new Workshop. The Mission Science Workshop staff have done this in a number of ways.

First of all, as we have already mentioned, they provided one-on-one assistance to the site directors as they came on board. The MSW staff divided the new sites among themselves so that each new director had at least one MSW point person who worked with them on a regular basis. MSW staff also invited these directors to the Mission Science Workshop in San Francisco to talk with staff, observe programs, and gather materials. Secondly, they went out to the sites and worked with directors and children at the new Workshops. Third, they held regular gatherings of all the site directors, where they shared project ideas, gathered more materials, built collective science knowledge through new projects, and talked about what was working well and not working well across all the sites.

Also, in addition to the site directors, the CSWs have found it helpful to build a core group of supporters at each site. In terms of the management of the sites, the CSWs often attract a diverse set of community advocates and local volunteers. We found that in the most successful cases, the oversight of the sites combines a person who serves the “tinkerer” role, with a person who serves as the (business) “suit” or “advocate,” whose responsibility it is to seek out and foster community connections. It is the role of “the suit” to raise awareness and funds, and take on the advocacy for the site in the community. In some cases, we found that the “tinkerer” and the “advocate” were the same person, but these directors were hybrids. More often the personality who is skillful at working with youngsters is not as skillful at garnering political and community support and vice versa. Or, those that are good at both simply don’t have enough time to fulfill both roles well. What is key is that every CSW site needs both roles to be played successfully – the day to day work with the children, as well as the building of sustainable partnerships in the surrounding communities.

The Importance of Dedicated or Committed Space

One of the key lessons learned about developing CSWs is the importance of having dedicated space for Workshop activities. Several sites began by sharing, or still do share, space with the agencies in which they are housed. This

situation is difficult for a number of reasons. One is that materials, projects and tools have to be set out at the beginning of each Workshop session and gathered at the end of each night. This places a limit on the types and nature of projects that youth can undertake; it also limits the number of exhibits that are available to participants to experiment with. Those sites that have found ways to have their own dedicated spaces are, in general, able to offer a wider array of projects, and more in-depth experiences to participants.

The Importance of Pacing the Growth

Another key lesson learned for the project overall and for individual Workshop sites is the importance of pacing the growth. Originally, the CSW grant called for funding the development of fifteen sites across California. It quickly became apparent, however, that each new site was going to require more assistance than originally thought. Thus, early on, project managers made a crucial decision to invest in fewer sites, but to invest in them more wisely and thoroughly with an eye toward long-term sustainability. Their efforts have paid off. There have only been two sites that the NSF grant set out to fund which did not succeed.

One of the factors that influenced the decision to invest in fewer sites throughout California was that the demand for satellite sites in a number of the largest urban areas grew quickly. Soon after they were up and running, the new Workshops in Oakland, Los Angeles, and Fresno all faced a demand for creating additional sites within their cities. We think it is a testament to the success of the Workshops that local city officials wanted to replicate the Workshops in other neighborhoods as soon as possible.

As with the establishment of the original sites, we saw that for the Workshops beginning to establish satellite sites, a key lesson to learn was the importance of pacing their growth. Los Angeles, for example, originally set up Workshops in two “demonstration” sites, neither of which could provide permanent space. While these two satellite sites did not work out in the long run, they did prove the feasibility of the Workshop model in Los Angeles, and built interest in the community in finding a permanent site. A permanent site was ultimately located in a LAUSD middle school. Since then, the directors at the USC-MESA Mission Science Workshop have slowly added additional sites in other neighborhoods as funds have become available. They have also added additional support staff to help them with the extra workload, including three classroom teachers who work with the youth at two of the elementary school sites.

Similarly, in Oakland, the site director pursued a grant from the City of Oakland and a space from the Housing Authority that has enabled him to set up a satellite site in West Oakland, run by his former assistant. Both of these

examples serve to illustrate that a slow, measured growth where the Workshop leadership is guided and mentored pays off in the long run with a sound foundation for a new, beginning venture.

These examples also suggest a model for moving a Community Science Workshop into a new city. The first step would be to establish a central Workshop with a strong director. Then with close support from MSW, and the other strong established CSW sites, the new Workshop would develop programs and train staff. In addition, the new Workshop would be used to demonstrate to local citizens and officials the power of the CSW model. After one or two years of successful operation, the Workshop could plan and implement another satellite site using the trained staff and community resources that have been developed over that period. Ultimately, the first Workshop in the city might well serve as the nucleus for a number of satellite sites spread throughout the city.

The Importance of Addressing Sustainability Early-on

Perhaps one of the most difficult lessons, but ultimately very important, is the importance of addressing issues of long-term sustainability from the very start of the development process. Many NSF projects promise “institutionalization” and “sustainability.” In our experience of studying many NSF-funded projects, the CSWs have been unusually successful in garnering local support so that they have indeed become an institutionalized and locally sustainable part of their communities. All of the CSW sites currently have been able to establish solid connections with their local communities. To varying degrees they have succeeded in generating long-term support for their Workshops. The Fresno Workshop works closely with Parks and Recreation and the Fresno Unified School District. The Brookdale Discovery Center is supported by the City of Oakland and Parks and Recreation, and recently received a Kid’s First grant from the City of Oakland, which is funding a satellite site in West Oakland. The LA MESA Mission Science Workshop has very strong and supportive ties with the University of Southern California.

The CSWs are viewed in the communities in which they are housed as crime and gang prevention programs, as youth development programs, as science education programs, and as after-school programs. Thus, there are literally many faces to each CSW. Depending on which face a given CSW chooses to show, it can “fit the bill” for a wide range of agencies looking to serve youth.

We have learned that to be most successful, site directors needed to think of their jobs as two parallel strands. While their first priority and central motivation is creating quality, informal, hands-on science experiences for neighborhood youth, they have to simultaneously address the sophisticated demands of project

administration, public relations, and fundraising. Thus, the development process is a very demanding one for the Workshop directors. They must simultaneously ensure that they are providing a quality set of programs for the youth in the community, and also begin very early on to seek additional funding sources. For example, in Fresno, while the site director ran the workshop with the children, he worked tirelessly behind the scenes with key contacts in the city government and the school district. He secured a permanent space (a portable building) for the workshop, as well as a commitment from the City of Fresno Parks and Recreation Department to continue to fund the workshop after the current NSF grant ended. Today the three “fully developed” CSW sites have gained sufficient local funding sources so that they can continue their operations without the support of the NSF grant.

The Importance of Maintaining Integrity of Vision in Collaborations

As the CSWs have developed, they have been successful in collaborating with other community agencies and organizations. Successful collaborations are difficult to establish and maintain, however. To be most successful, the CSWs have had to find ways to work with other agencies that are mutually beneficial, while still preserving the integrity of their Workshop identity. Most importantly, they have had to find ways to work with these agencies that do not require them to compromise the CSW vision.

Some sites have found this to be especially tricky. For example, some of the school districts in which CSWs are housed may want the CSWs to become extensions of the school day, or to “prove” that they are engaging youth in activities that complement or support the school’s curriculum. Similarly, Parks and Recreation departments may want the Workshop to engage children in activities that do not fit the nature and purpose of the Workshop.

It is important to note that many of the hardest struggles faced by the CSW directors centered around the interaction of the CSWs with other existing organizations. Particularly, when the CSW was “hosted” by another organization (e.g., a school or a Parks and Recreation department) it became very important to establish the independent identity of the CSW while at the same time creating a collaborative working arrangement. The CSWs that succeeded in maintaining their identity while also building successful and symbiotic relationships with other community groups and agencies developed great strength from doing so.

Thus far, the CSWs have been able to walk the fine line between collaborating without sacrificing their own integrity and maintaining their own strong visions of their mission and purpose. And it is important to note that being part of a

statewide Community Science Workshop network has been very helpful to directors as they fought to maintain the vision and purpose of their CSW.

The Importance of Finding Adequate Adult Help and Volunteers

In the first few years of the CSWs, most sites have had fewer adults working with larger numbers of participants than is optimal. While studying the sites we learned the obvious: that it is crucial not only for safety, but also for the depth and quality of the youth experiences, that there be adequate numbers of adults working with participants.

We found that when there was insufficient staff support at a site it leads to a negative syndrome that was impossible to readjust without more human resources at the site. When the sites were understaffed sometimes directors had to respond only to crisis situations while not addressing other important, but less urgent needs (e.g., discussing the science concepts behind a project). It necessitated them working extra hours to clean and maintain the facility, and having to do public relations work on their own time.

Another outcome of insufficient staffing is that directors lack the time needed to train volunteers. CSW directors have recognized that volunteer support and increased parent participation are two possible solutions to this challenge, however, taking the time to recruit and train volunteers is a drain on the limited time and resources of the site leadership.

The Importance of a Network of CSWs

The demands of developing and operating a CSW are daunting. Thus, it is not surprising that we found the network of CSW sites to provide a much-needed support system for individual site directors. Site directors have benefited from being part of a larger group of people taking on similar challenges throughout the state. The benefits of a network become apparent as site directors learn from each other (there is no other source of expertise about Community Science Workshops), and as they provide support to each other in difficult times.

Thus far, the CSW network has been supportive, but has remained largely untapped and undeveloped. Although in need of a staff to coordinate and sustain it, the foundation is laid for a fully functioning state and/or national network of CSWs. The potential benefits of a national CSW network include supporting collective proposals for funding, facilitating communications between the Workshops, communications with community and host institutions about program and operational decisions, and with the media. A network would also provide each individual site all of the supports that come from being affiliated with a large prestigious national network.

The Importance of Addressing Program Quality and Policy Issues

A final area in which we learned an important lesson about the CSWs is in the area of program quality and policy issues. The logistics and management of running a drop-in program can be overwhelming, and the immediate and concrete problems that arise are always uppermost in directors' minds. To name just a few – there are always questions about how best to handle overcrowding, how to figure out the best schedule of days and hours to be open, and how to challenge the youth, while maintaining their focus and attention.

In general, the Workshops have found their participation numbers to be somewhat self-limiting – that is, because the Workshop space is only so large, and when materials and staff time are limited, and the noise and energy level are quite high, the participants tend to regulate their own numbers.

However, given a chance to step back from the day to day running of their programs, site directors face deeper questions about the overall quality and design of their programs. They have, for example, questions about the balance between more structured, self-directed projects and more open-ended, independent activities. A general concern with the quality of the science offered by the CSW programs is shared by all directors. One aspect of this is a question about the type of projects which are appropriate for a CSW. What is the appropriate balance of projects between the more woodshop-type experiences versus ones that are more directly science-related? Also, what is the appropriate balance between short-term projects and more in-depth, longer-term projects for a drop-in program?

SUMMARY THOUGHTS

The CSWs represent a new kind of social and educational investment. Located in the heart of inner-city neighborhoods, they make available to the youth who live there rich inquiry and science learning experiences; they provide these youth practical experiences with tools; and they provide an opportunity for youth to experience a strong mentoring relationship – all of which encourage youth to be creative and productive.

The workshop sites throughout California all have been established and structured with great care, intention, and integrity of vision. They are in the “right” locations and have strong and well-supported leaders. The existing CSWs have proven the feasibility of the community workshop model. These same workshops, and their increasingly experienced directors, could also now form the nucleus of a much larger network of Community Science Workshops. The idea is worthy of pursuit.