San Francisco, California

A University Works Collaboratively with a City School District

The San Francisco Unified School District serves approximately 35,000 elementary students in 75 elementary schools. Students come from urban and suburban neighborhoods across the economic spectrum. Eighty-five percent of San Francisco's students are minorities, including African American, Hispanic, and Asian. Thirty percent of the students come from families in which English is not the primary language.

City Science is the story of a successful collaboration between the University of California San Francisco (UCSF) and the San Francisco Unified School District. Between 1991 and 1995, City Science worked closely with the district and made significant contributions to the professional development of 100 teachers and the development of teacher-scientist relationships. Bruce Alberts, then a faculty member at UCSF and now president of the National Academy of Sciences, was instrumental in starting City Science.

The year was 1991. City Science, a project sponsored by the University of California at San Francisco (UCSF) in collaboration with the San Francisco Unified School District (SFUSD) through their Science and Health Education Partnership (SEP), had just received funding from the National Science Foundation (NSF) to implement a districtwide elementary science reform project.

City Science had developed a simple design for the program. Its goal was to expand the use of hands-on, inquiry-centered science teaching in the district by training a cadre of 100 lead teachers over four years. These teachers would be responsible for bringing the inquiry-centered approach to their schools. City Science also had secured funding to hire a full-time science resource teacher who would provide support to classroom teachers and be responsible for refurbishing the science kits.

But plans have a way of changing once the work actually begins. When City Science coordinators began implementing their program, other science education initiatives were already under way. In 1990, the California State Department of Education had published a radically different science framework, which stressed the importance of teaching the "big ideas" of science, such as energy and scale and structure. According to the district's adoption cycle, it was slated to align its curriculum with the California framework by 1992.

Another influence in the district was the program sponsored by School in the Exploratorium (SITE), a museum-based professional development effort. SITE had been training district teachers for more than a decade through intensive four-week institutes focusing on science inquiry. Finally, the school district had established the San Francisco Science Leadership Project, a three-year program designed to provide intensive training to 27 teachers who would be charged with the task of bringing inquiry-centered

science to their schools and making key decisions about the science curriculum.

What proved to be the link among these programs was the teachers, who worked together and discovered how their teaching could be strengthened by sharing ideas with their peers.

A Push for Professional Development

When City Science began work on the NSF project in 1991, its main vehicle for training was slated to be a kit-based curriculum program. Initially, the teachers were intimidated by the kits. "It was like going to the dentist to get the teachers to open the kits and get going," recalls Janice Low, former City Science director. "It's very scary to change your whole program overnight-to let the unknown into your classroom. Teachers wanted to improve their science teaching, but they had to be encouraged to use the new curriculum units."

City Science coordinators decided to proceed slowly. During the summer institute, the lead teachers used selected modules as a starting point to explore relevant science content, pedagogy, alternative assessment strategies, and leadership development. They received stipends and graduate credit for their involvement in the program.

At the end of the first summer institute, the teachers were given a full year to assimilate what they had learned and to prepare themselves to work with other teachers at their schools. Jan Tuomi, one of the program's founders, thinks that giving the lead teachers time to learn was a significant factor in the success of the program. The hiatus gave the participants an opportunity to practice what they had learned: to refine their teaching styles according to principles of inquiry-centered learning, to reflect on their classroom experiences, and to crystallize their own thinking about the instruction they had received. As a result, City Science alumni are now more effective and credible as coaches to their peers.

Over the subsequent three years of the program, City Science also discovered the importance of drawing on teachers from the city's other two major science reform initiatives. Science Leadership Project teachers served as mentor teachers for City Science summer institutes, and City Science teachers participated in workshops held at the Exploratorium. Graduates of the Exploratorium's programs also became involved in City Science and the Science Leadership Project. In these ways, the three separate programs became more united in their efforts and succeeded in training a large pool of teachers.

The Role of Scientists

Scientists had an integral role in the City Science program. After considering several approaches, the program initially opted to team each of six master teachers, one from each grade, with two UCSF scientists. During the first summer institute, the scientist-teacher teams introduced participants to inquiry-centered science modules. Over the subsequent three years, however, teachers worked with only one scientist.

The SEP executive director and City Science's co-principal investigator, Liesl Chatman, believes that scientists have much to gain from being part of such a partnership. "It's not a partnership if the scientists aren't learning," she says. "The scientists aren't just there to reform elementary science in the classroom- they're there to learn something themselves….When the benefit is all the way around, the partnership becomes meaningful and sustainable."

Margaret Clark, SEP director and science coordinator for City Science, was among the first scientists who worked with teachers. She found the experience enlightening, giving her a "strong appreciation of teachers' teaching skills and an understanding of how to facilitate learning." Clark also found that "scientists are very good at making connections between major concepts and daily phenomena, which is very important in making science relevant to both teachers and students."

Teachers, too, found the partnership enormously beneficial. "Scientists put more credibility into what we were doing," says Denise Ebisuzaki, a third-grade teacher in San Francisco. "They were able to catch errors before we conveyed them to students. For example, in one module, scientists helped us understand that the teacher's guide had specified the wrong wire length to complete one experiment. A mistake like that could make or break a lesson."

Curriculum Adoption and Its Ramifications

In 1992, the district adopted module-based, inquiry-centered science curriculum materials for all 75 of the district's elementary schools. The materials support the core curriculum, which was developed in 1990. City Science and district teachers collaborated on the final choice of curriculum materials, which included modules from both the Full Option Science System and Insights. At this point, the district faced a new challenge: How could all of the elementary school teachers be prepared to begin teaching inquiry-centered science? Where would the district find the resources for this enormous undertaking?

To resolve these issues, the district asked City Science and its cadre of 100 lead teachers to join a smaller group of the SFUSD science leadership teachers and mentor teachers to become presenters, mentors, and leaders in efforts to introduce all of the district's teachers to inquiry-centered science. As part of this development effort, the district hired an outside consultant who showed the teachers how to organize workshops and gave them opportunities to practice on each other. "We told teachers that their experience with the modules was invaluable," says Low. "They know the day-to-day difficulties of working through the modules. Their experience gave them credibility with other teachers."

In the end, the teachers' hard work paid off. "I loved taking a leadership role and helping other teachers out," says Dan Brady, a third-grade teacher. "We were able to introduce the teachers to the modules in a structured way." Low concurs, noting that for the first time in the district's history, teachers were given six professional development days over two years, which enabled them to build a foundation for beginning to implement

the modules. Low calls this move "unprecedented" and a "big risk" for the new superintendent, who made the final decision on the basis of his observation that a strong science program often meant that the school was operating at a high level. Through the training experience, City Science teachers grew as leaders, and the district teachers were better equipped to teach the science modules.

Materials Support

To further support the modular-based science program, SFUSD has established a central materials management center. It asks the schools to take more responsibility for their maintenance than other districts do, however. The system works like this: Each school in the district is issued four modules for every two teachers at each grade level. Generally, the kits contain enough consumable materials for two classes to use before a refurbishment request is sent back to the materials center. When the kits are ready for refurbishment, a lead teacher or an administrative staff member completes the necessary requisitions for the replacement materials. The materials are then sent back to the school, again with a sufficient quantity of supplies for two uses. The kits are kept at the schools, not at the materials management center.

Although the system has worked fairly well, some teachers point out that not all of the problems have been worked out of the materials aspect of the program. "The reordering process is time-consuming and burdensome," says Brady. "I think it would be easier if the district created a new order form, where we could check off what we needed instead of having to write it in. In my view, the materials component is critical: without the supplies, teachers won't use the modules."

Future Plans

In 1995, the UCSF and SFUSD received a five-year Local Systemic Change Initiative grant from the NSF to continue and greatly expand the City Science effort. The new grant will support the strengthening of leadership from within the district. One of City Science's most important contributions to science education reform was realizing that the district- not outside consultants- must take the lead. "Establishing an appropriate leadership structure is key," says Chatman. "The district must come first."

The new grant will also strive to bring more teachers into the program and to raise the level of inquiry-centered instruction by those already using the modules. It also includes an important new feature- eight focus schools designed to become models for science education reform at the school level. Planners have to involve the whole neighborhood in the effort, including parents, businesses, and other local resources.

City Science teachers and staff are looking forward to continuing the work begun over the past four years. As she prepares to embark on the second phase, Clark reflects on the program's progress to date. "Science education reform is never really 'finished,'" she says. "Progress is ongoing. The real issue is to leap from working with a small, committed group of teachers to going districtwide. It's difficult to communicate with and

motivate other teachers outside the small group. It's a huge leap, and we're just at the beginning of that task."

Lessons Learned

- Although partnerships are an effective way to bring about change in science education, the outside organization must learn how to collaborate with the school district. Reform will be most significant when the district assumes a strong leadership role.

- Professional development is crucial, because it provides teachers with the support they need to teach inquiry-centered science effectively. Furthermore, teachers need time and additional training if they are to become leaders of science education reform at the district level.

- Forming partnerships between scientists and teachers can add an important dimension to the district's professional development program.