

PS Science History and Operational Overview

A. Organizational Summary

Founded in 1971, Crossroads School provides a unique K-12 program built on a progressive, developmental model of education. Crossroads believes that a comprehensive education includes a focus on not only academic skills and knowledge, but also on emotional and social well-being. Integral to this focus on the whole student is a commitment to fostering social, political and moral understanding and responsibility, most notably the importance of community service.

To model this idea for students, Crossroads developed Crossroads Community Foundation in 1984 (renamed Crossroads Community Outreach Foundation “CCOF” in 2004), whereby the school as an organization commits to “institutional community service.” The first “institutional community service” project pursued was P.S. Arts, designed to make quality arts programs available to underserved public schools. That program now serves more than 25,000 students each year in the Los Angeles area and the Central Valley as is an independent 501(c)3 organization.

In 2006, CCOF launched PS Science in response to the persistent need for early elementary school science education. No Child Left Behind created a powerful test-driven instructional culture in public schools, and since science is not tested till after 3rd grade, science is not taught unless parent groups step in to provide funding and motivation. The result of this is that in Title I schools, science instruction in the early elementary grades is essentially non-existent.

PS Science fills that gap by bringing high-quality, age-appropriate elementary science education to more than 1,200 students in Title I schools annually. Students engage in weekly, in-school-day, hands-on, engaging instruction. The initial objective of PS Science was to produce documented high-level learning outcomes in students. As the program has evolved, it has achieved that objective, and it does two other very important things for the schools it serves.

PS Science provides professional development and capacity building to the on-site teachers who work weekly with PS Science’s elementary science specialists. We have found that after two to three years of working with the PS Science instructor, most of the site classroom teachers are confident and eager to take over the instruction themselves. This, of course, allows the PS Science instructor to move to a new classroom. Our comprehensive teacher training agenda prepares classroom teachers to have the confidence and knowledge to integrate the PS Science curriculum into their weekly schedule on their own.

PS Science also provides another significant benefit to the schools served. All public schools have been accountable to Common Core standards for some time, and many struggle to meet them. Now, in addition to that, California has adopted Next Generation Science Standards (NGSS), which is a new layer of standards to which schools will be accountable in 2018. The prospect of developing curriculum and

providing teacher training that will meet both Common Core and NGSS standards is a daunting proposition for underfunded Title I schools. The PS Science curriculum has been designed so that it is both Common Core and NGSS aligned and compliant. This lifts a significant burden from teachers and administrators in the schools we serve.

In the 2016-17 school year, PS Science served four Title I schools – McKinley Elementary School and Saint Anne School in Santa Monica, King Elementary in Compton, and William Green Elementary School in Lawndale. When we started PS Science, we assumed that since science testing starts after third grade, schools would already have in place strong science programs in grades four and five. What has emerged is that students, teachers and administrators have come to us and asked that we extend PS Science through grades four and five because it is so much stronger and more engaging than what they have been able to provide. This was not in our original mission, but we are gradually expanding our curriculum to serve grades K- 5. Last year, we piloted PS Science in grades 4 and 5 at William Green, and will expand the program this year there, with the ultimate goal of providing a full 4/5 program at all partner schools. McKinley Elementary implements a “P.S. Science aligned” 4/5 program that is funded through the school’s discretionary funds. In the 2017-18 school year, we will pilot our kindergarten program at St. Anne and St. Anastasia schools.

The demographic distribution of the schools served by PS Science is approximately 55% Hispanic students, 18% White students, 10% African-American students, 5% Asian students, and 12% multi-racial students. The combined percentage of socioeconomically disadvantaged students at the four schools, approximately 71%, well exceeds the federal Title I standard.

B. Program Description

Need for Program

ACT provides college admissions and placement testing to 1.8 million high school graduates annually, and they have noticed a disturbing trend. Though graduating high school students from underserved backgrounds (defined for the purposes of their research as minority, low-income and/or first-generation college matriculating) have a nearly identical interest in STEM careers as the general student population, their scores on the math and science College Readiness Benchmarks are roughly 1/3 lower than average.[1] These students are wisely hoping to enter intellectually stimulating fields that lead to well-paying, in-demand jobs, but their K-12 school systems have inadequately prepared them for the rigors of college coursework, beginning with the absence of science from the earliest days in the classroom.

As troubling as this disparity between student interest and skill level may be, it is hardly surprising. Socioeconomic gaps in academic achievement are on the rise in the U.S., even as racial gaps are declining.[2] In California public schools specifically, the mandated statewide testing does not include science until 5th grade, which means that schools are incentivized to displace science in favor of other subjects before that age. This de-prioritization occurs despite the fact that early exposure to scientific concepts can markedly improve more formal acquisition of scientific skills in later education, and that children incur a variety of broader developmental benefits from the early use of analytical thinking.[3]

Even in schools that are attempting to prioritize early science education, our conversations with teachers have yielded two additional roadblocks: limited classroom materials budgets and a perceived lack of content knowledge. These informal findings sync with national level research that teachers spend hundreds of dollars out-of-pocket annually on supplies,[4] and with the California Council on Science and Technology's 2010 research that first-year multi-subject teachers feel less comfortable with science than with any other topic, and do not receive the training to become more comfortable over the course of their careers.[5]

In short, students from low-income backgrounds experience science in the classroom at a later age than their more affluent peers, leading to a skill gap that extends throughout their academic career. PS Science is determined to change this, beginning with four schools in our own backyard.

Program Objectives

Objectives for the 2016-2017 school year:

- ∅ Approximately 1,200 students at four Title I elementary schools will participate in hands-on science education that would not otherwise be offered.
- ∅ Each participating student will have access to 90 minutes weekly of age-appropriate science instruction and activities over the course of the entire school year.
- ∅ At least 95% of all students will give PS Science an overall satisfaction score of 4 or 5 on a 5-point scale at the end of the school year.
- ∅ Every participating classroom teacher will receive training and support from a trained PS Science educator.

The anticipated outcomes for the 2016-2017 school year are as follows:

- ∅ Fun, engaging, and personally relevant science instruction and activities lead to self-reported and teacher-witnessed increases in student interest and capability in science.
- ∅ Students develop their facility with the eight core science and engineering practices of the Next Generation Science Standards. These practices are:
 - o Asking questions (for science) and defining programs (for engineering)
 - o Developing and using models;
 - o Planning and carrying out investigations;
 - o Analyzing and interpreting data;
 - o Using mathematics and computational thinking;
 - o Constructing explanations (for science) and designing solutions (for engineering);
 - o Engaging in argument from evidence
 - o Obtaining, evaluating and communicating information.
- ∅ Teachers report increased confidence in conducting hands-on science instruction.

Anticipated long-term impact from the program includes:

- ∅ Participating students have the necessary skills to thrive in high school and college science coursework, as well as in science careers.
- ∅ Title I schools across Los Angeles and, eventually across California and the U.S., see the success of the P.S. Science model, and prioritize elementary science instruction.
- ∅ Participating students increasingly identify science as a viable career path.

The PS Science Board has devoted all its resources into program development and the development of effective outcomes. Now that program has been perfected, we are focusing on revenue growth so we can expand. The Inglewood Unified School District is eager to have PS Science in its classrooms, as are more schools in the Santa Monica-Malibu Unified School District and Los Angeles Unified School District. Our goal is to begin formal partnerships with these districts in the 2017-18 school year.

Program Activity, Components and Execution

The PS Science model includes 90 minutes of instruction per week per class, and progresses from PS Science instructors in the classrooms, guiding lessons directly, to partner school teachers teaching the lessons themselves, or with the on-going support of a PS Science “facilitator.” Lessons are delivered using the 5E model of science instruction, which includes:

- ∅ *Engaging* students with a text, experiment, photograph, or other learning tool, as a means of reinforcing what is already known and encouraging them to use their “scientific thinking toolkit” to process what is being presented.
- ∅ *Exploring* together through hands-on activities provides a set of common experiences for all learners and helps students grasp the concepts and skills and they will carry through their academic careers.
- ∅ *Guiding* students as they *explain* the concepts and processes about which they are exploring and learning. Teachers clarify students’ understanding of concepts and help them develop skills, but do not didactically present the meaning of what students’ experiences.
- ∅ *Expanding* on students existing understanding and helping them connect what they already know to new situations.
- ∅ *Evaluating* students’ progress through the lens of their own assessments of their knowledge, skills and abilities, allowing teachers to evaluate students’ progress and refine their teaching tactics on concepts that are not gaining traction.

This model prioritizes students “figuring things out,” the core principle of science and one of the most important concepts in the Next Generation Science Standards (NGSS), a multi-state effort to revitalize science education, endorsed by the [National Science Teachers Association](#), the [American Association for the Advancement of Science](#), the [National Research Council](#), and adopted by the State of California. It is built on active investigation and hands-on exploration, and assumes that scientific content knowledge can only meaningfully flow from a rich process of asking questions and testing assumptions. Throughout the science instruction and activities, language arts and math are also being included in educationally sound ways, through measurement, definition of new terms, and the like.

Each grade level NGSS-aligned curriculum is a blend of biology, physics and motion, and chemistry/materials and interactions and engineering. Curricular highlights include:

∅ In grade one, students study the senses and their role in scientific observation; bodies and body parts as a means of understanding what makes something human, animal, or plant; and seasons and shadows as lens into the role the sun plays in our world.

∅ In grade two, students study, among other topics: wind, water and the sun as sources of energy; dinosaurs, bats, and various biomes as a means of connecting to the natural world; and building a model car to illustrate key concepts around friction and motion.

∅ In grade three, topics include: weather and the water cycle; early concepts in natural selection and evolution; and how some of their favorite playground toys demonstrate laws like gravity and motion.

Public schools across California will begin piloting NGSS test assessments in the 2016-17 school year for grades 5, 8 and 11, with full-scale testing implemented in 2018-19. As the grade 5 test encompasses materials learned in grades 3-5, P.S. Science students will be better prepared than their peers because NGSS standards are already built into their curriculum. This benefits teachers and schools, too, via a reduction in their curriculum development load.

Summer Camp

We are thrilled to announce the 2nd Annual PS Science's first annual S-Team Rangers Summer Science Institute June 19- 30, 2017. The two-week, full-day camp for 28 incoming 4th and 5th grade students was designed to provide highly interested and motivated students the opportunity for more in-depth science investigation. The camp utilized the new science facility on the Crossroads School's upper campus.

Dressed in their official lab coats and with lab notebooks in hand, students built solar cars, created flying machines, programmed robots, created a kinetic structure, and so much more. The program was free of charge for PS Science students at McKinley and William Green Elementary; participating Crossroads students paid a fee. Transportation was provided to and from Lawndale.

Teacher Training

A critical element of the PS Science model involves building internal school capacity for science instruction. CCOF does not have the capacity to reach every student who would benefit from elementary science instruction, but preparing in-school teachers to deliver the curriculum while PS Science instructors scale back their own involvement allows for sustained impact.

The first level of training for partner school teachers is two years of observation and assistance. PS Science instructors are taught that, from day one, they should be teaching in such a way as to empower partner schools' teachers to eventually take the lead on all instruction and activities. Partner schools' teachers are supported to deliver the Engage and Evaluate stages of the lesson, and in turn support the PS Science instructors while they deliver the more content intensive phases of the lesson, and are then given in-school time to ask questions and review methods.

By year three, partner school teachers are leading the lessons, and PS Science teachers are playing a support role. To reach this milestone, observation is coupled with more structured training. The focus of the training is on effective use of the 5E inquiry-based model: helping students think, learn, and investigate in a scientific way, as opposed to focusing on content knowledge that will be prioritized in later grades. Observation and direct instruction on the 5E teaching framework are complemented by the sharing of age-appropriate books, apps, and other resources for use in the classroom.

Profile of Youth Directly Served

In the 2016-17 school year, PS Science served 1,200 students at four Title I elementary schools – McKinley Elementary School and Saint Anne School in Santa Monica, Dickison Elementary in Compton, and William Green Elementary School in Lawndale. The demographic distribution is approximately 55% Hispanic students, 18% White students, 10% African-American students, 5% Asian students, and 12% multi-racial students. The combined percentage of socioeconomically disadvantaged students at the four schools, approximately 71%, well exceeds the federal Title I standard.

Evaluation

Dr. Leah Melber, (Ph.D. in educational psychology, University of Southern California) conducted an annual evaluation of the P.S. Science program in 2013. A leading thinker on the connections between formal and informal education, the use of technology in the classroom, and student-centered educational approaches, Dr. Melber studies the impact of the program on students, teachers, and students' home environments.

Dr. Melber's most recent analysis found that the program consistently keeps students' interest, as evidenced by high levels of teacher-reported student engagement (4.5 and higher on a five point scale). Anecdotally, she also heard from parents (as we have) that their children are bringing scientific approaches home. Parents regularly share observations like, "She is more observant and she asks questions when she is curious about the ways things work or where they come from," or "She takes notes at home when she's watching birds," which demonstrate not only development of core science skills, but excitement about using them. Parents also appreciate that the program empowers them to build on classroom activities, and one parent commented, "I like the (materials) that were sent home so I knew what she was learning about and we could talk about it."

With regard to teachers developing their science content knowledge and instructional skill, the teachers themselves identify, and the administrators confirm, that they feel more confident teaching science and that the PS Science instruction has sparked their creativity in terms of incorporating scientific modes of thinking into every area of classroom instruction. One teacher put it this way, "It's definitely changed (my comfort with science)...It's really helped me grow as a professional (and) my confidence level has really grown because of PS Science." The level of satisfaction was a result of carefully considered curriculum for them, and in the most recent evaluation, 100% of responding teachers were satisfied with the level of instruction and support they received.

The teachers are also clear about the multitude of positive effects the work has on students. In the words of one McKinley Elementary School teacher, "PS Science impacts students' vocabulary and their level of understanding. It aids in strengthening our classroom community as many of the projects involve working and thinking together. It also provides a nurturing environment in which they can easily understand complex concepts."

C. Partnerships

McKinley Elementary

Saint Anne School

William Green Elementary

Through a grant from the Angell Foundation, PS Science partnered with P.S. Arts to provide 12 weeks of STEAM instruction to all third graders at King Elementary in Compton.

D. Timetable

PS Science runs on the school calendar year, from early September to mid-June. Summers are used for instructor training, evaluation and programmatic analysis, curriculum refresh and review, and strategic planning.

E. Program Staff

Julie Olds, Executive Director. Julie has been involved with PS Science since it's founding in 2006. She is responsible for overseeing the growth and implementation of the PS Science program, developing curriculum that aligns with NGSS and the Common Core, teacher training, procurement of materials, planning and implementation of evaluation studies, supervision of instructors, and general oversight of all program facets. Prior to working with PS Science, Julie was both an arts and science teacher at Crossroads School for Arts and Sciences from 1986-2008. Concurrently from 1993-2002, Julie served in various capacities at the Natural History Museum of Los Angeles County, namely as an Exhibit Education Specialist and Curriculum Developer, Manager of On-Site Programs, and Discovery Center Supervisor.

She holds a BS in Biology from Loyola Marymount University, an MFA in Photography from the Maryland Institute College of Art, and has completed coursework in Graduate Science Education from the University of Southern California.

Roger Weaver, President, Crossroads Community Outreach Foundation. An educator with over forty years of experience in independent schools, Roger Weaver served as Headmaster and CEO of Crossroads School for Arts and Sciences (K-12, 1150 students) for sixteen years, completing his service in 2009. He is president of the Crossroads Community Outreach Foundation and is the founder of PS Science.

Prior to joining Crossroads, Roger Weaver was Middle School then High School Principal of La Jolla Country Day School starting in 1979. He began his teaching career at Flintridge Preparatory School in

1967. Weaver earned a Bachelor of Arts degree in English from the University of California, Santa Barbara and a Master's degree in Education from the University of California, Los Angeles. Born in South Africa and raised in England, Mexico, Canada and the United States, he brings a distinct blend of experience and cultural perspective to his work.

Now a consultant to non-profit organizations and leaders, Weaver has served on the boards of numerous educational and public interest organizations, including the California Association of Independent Schools and the Independent School Alliance for Minority Affairs. He currently is chairman of the Rancho La Puerta Board of Directors, and board member of the P.S. Arts Foundation and of the Center for Early Education.

Sherry LeMire, PS Science Lead Instructor. Sherry oversees the implementation of the PS Science program at partner schools. She trains and mentors the four PS Science Instructors and acts as a communication liaison with school districts, principals, and classroom teachers, providing necessary orientation, training, scheduling and logistics. In addition, Sherry is responsible for collecting program documentation for purposes of evaluations and development as needed. Sherry works side-by-side with the Program Manager and reports directly to the PS Science Executive Director.

Megan Walsh, PS Science Program Manager. Megan carries out the administrative and organizational duties for the successful implementation of the PS Science program. She works side-by-side with the Lead Instructor to trouble-shoot and plan for week-to-week program needs. Megan reports directly to the PS Science Executive Director.

Hallie Perez, PS Science Supplies Coordinator. The PS Science Supplies Coordinator oversees the week-to-week preparation and delivery of weekly program materials and works side-by-side with the PS Science Lead Instructor and Program Manager to ensure that the PS Science program is implemented successfully at partner school sites. This job requires driving between the PS Science Headquarters and school sites to deliver and collect program materials as needed. The PS Science Supplies Coordinator reports directly to the PS Science Program Manager.

F. Governing Board List

Leslie Aronzon. Crossroads School Parent; Brandeis University Board of Trustees; Jewish Free Loan of Los Angeles Board of Directors.

Sharyar Baradaran. Dentist in private practice.

Eric Borstein. Borstein Enterprises.

Mary Farrell, Secretary. Crossroads School Board of Trustees.

Heather Felix. UCLA

J. Lloyd “Bud” Jacobs. Adjunct Professor, UCLA

Marc E. Hankin, Esq. Registered Patent Attorney, Hankin Patent Law, APC.

Alex Klyce. CathodTV.

Jennifer Michael, Crossroads parent.

Rachel Roth. Program Officer, Crail-Johnson Foundation.

Corrine Shulman, Director of Advancement, The Curtis School.

Roger Weaver, President, CCOF. Weaver Consulting Group.

Gennifer Yoshimaru. Assistant Head of School for Advancement, Brentwood School.

The Board meets every two months and comprises the following committees: governance, development, by-laws (ad hoc), strategic assessment, communications.

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- [1] Understanding the Underserved Learner—The Condition of STEM 2014;
<http://www.act.org/newsroom/many-underserved-students-have-interest-in-stem-but-few-are-prepared-to-succeed-in-college-stem-courses/>
- [2] The Widening Academic Achievement Gap between the Rich and the Poor;
http://www.frbsf.org/community-development/files/CI_Summer2012_Reardon.pdf
- [3] Should Science Be Taught in Early Childhood?;
<http://link.springer.com/article/10.1007%2Fs10956-005-7198-9>
- [4] Study: Average teacher spends \$500 of own money on classroom supplies;
<http://www.masslive.com/news/index.ssf/2014/08/teachers.html>
- [5] The Preparation of Elementary School Teachers to Teach Science in California;
<https://ccst.us/publications/2010/2010K-6.pdf>