Teachers As Science Champions

The Legacy of 15 Years of NSF Investment in Science Education Improvement

Summary Report

A Retrospective Study of Bay Area Schools for Excellence in Education (BASEE), Partnership for Student Success in Science (PS^3), and Noyce Master Teacher Program (NMTP)

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> *When I look back over the past 10 to 15 years, I think I've had a big influence on a small group of teachers who had a long-term involvement in activities like our BASEE and later PS^3 leadership study group. I saw those teachers taking on leadership positions in new ways, continuing the work, and at the same time reflecting and refining their science practice. For those individuals and others like them there is a legacy from the BASEE, PS^3 and NMTP projects because they were really helpful to them. The people who benefited will continue to grow and change and seek out resources, and so that is a really good thing.*
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> **Former BASEE, PS^3 and district Science Resource Teacher**

We at Inverness Research have conducted a "legacy study" focusing on a series of investments in science education in the San Francisco South Bay Area that extended for over 15 years. Roughly nine school districts enjoyed a steady stream of support for science education improvement. The effort built upon the foundations of original funding from the Hewlett-Packard Foundation for the *K-6 Hands-On Science Program* in the early 1990s; launched a more comprehensive endeavor with *Bay Area Schools for Excellence in Education* (BASEE), a National Science Foundation (NSF) Local Systemic Change (LSC) grant in 1997; extended into the *Partnership for Student Success in Science* (PS^3), a NSF Math Science Partnership (MSP) grant funded from 2003-2008; and finally ended with the *Noyce Master Teacher Program* (NMTP), a NSF Noyce grant funded from 2008-2013.

Conducted five years after the finish of the MSP grant and in the concluding months of the Noyce grant, the study's broad goal was to assess, understand and portray the lasting benefits of an unusually long-term, sustained funding effort. A retrospective study is a rare opportunity to explore the residuals or enduring benefits of investments in improvement programs. It is even more rare to study the effects of continuous funding in a single targeted region.

Questions that Framed this Legacy Study

The major questions that guided our study:

- What are the legacies of the BASEE, PS^3 and NMTP efforts?
- What residual effects and capacities remain?
- What are the implications for funders?

Our Methodology

We began this legacy study in January 2013 and concluded in October 2013. Our research activities included: reviewing pertinent background material on both PS^3 and NMTP; conducting several iteratively building interviews with the project leaders; interviewing 21 teachers, representing eight districts; interviewing three district level administrators and six principals, representing six districts that had been or still were involved in BASEE, PS^3 and/or NMTP; and analyzing transcripts, looking for key themes and issues.

Our Findings

The BASEE, PS^3 and NMTP efforts were high-quality

Both administrators and teachers with knowledge and experience of the BASEE, PS^3 and NMTP projects almost unanimously agreed on their high quality. They also converged on the following features of the projects that resulted in positive, lasting influences on participants:

- BASEE and PS^3 were systemic change efforts **deliberately designed to address multiple levels of the system**, which was critical for district level support for science education improvement.
- The projects' **strong attempts to include district level participation** frequently ensured district "buy-in" and support for teachers.
- BASEE and PS^3 included specially designed **professional development for school principals.**
- As a result of the deliberate emphasis on including school and district administrators in the programs, BASEE and PS^3 **increased the overall pool and capacity of instructional leaders to advocate for science**.
- The **science materials and kits were made readily available to all and central to the program** teachers were asked to teach.
- All the districts involved with BASEE and PS^3 **established some kind of system for maintaining and refurbishing the science kits.**
- The **professional development for teachers was intensive, addressing multiple dimensions of need** by providing science content, pedagogy (especially inquiry), integration of science and literacy, as well as kit usage.
- All three initiatives made **outside expertise and resources available to teachers and administrators.**
- **Relationships and connections with other schools and districts were established** and flourished during the BASEE/PS^3 efforts.
- The professional education teachers received about the **nature and development of professional learning communities was especially beneficial** as participants endeavored to share with colleagues in their home schools and districts.
- All three projects **increased opportunities for teacher leadership**.
- Finally and most importantly, all of those we interviewed said the primary benefit of BASEE, PS^3 and NMTP was that **more science teaching happened in their schools and districts**.

The BASEE/PS^3/NMTP professional development was of exemplary quality

When we asked 20 teachers to rate the overall influence of BASEE, PS^3 and NMTP on their professional life on a scale of 1 to 5, with 5 being the highest, 55% rated the influence the highest, 5; 40% rated it 4; only one rated it 3; and there were no 1 or 2 ratings.

When we asked teachers to describe the influence of BASEE, PS^3 and NMTP, what emerged was a list of key design features of the programs that teachers cited as especially significant to them:

- Teachers found **professional community** through the BASEE/PS^3/NMTP projects. They welcomed **working and learning collegially**.
- The **BASEE/PS^3/NMTP professional development experiences were intensive and long-term**. Especially in contrast to the limited professional development most teachers had encountered, such as attending conferences or day-long workshops, the immersion into professional learning over several years was impactful.
- The **BASEE/PS^3/NMTP professional development was rich in content learning.** For elementary teachers, learning more science content addressed a deficit they felt. For middle school teachers, participating in non-generic, subject-matter specific professional development where science content was the focus was a very welcome boon.
- **BASEE/PS^3/NMTP professional development was also rich in innovative pedagogy**. Teachers learned about pedagogical strategies such as differentiation or the use of writing in science instruction, but **the most significant pedagogy, mentioned most frequently, was inquiry.**
- Teachers said that an important feature of the BASEE/PS^3/NMTP professional development was that **teachers were asked to reflect on and inquire into their practice.**
- Teachers reported that they were treated as "professionals," a stance showing **respect for and trust in teachers**.
- BASEE/PS^3/NMTP offered teachers **unique access to both regional and national level resources and expertise in science** that they would not have had otherwise in their more isolated local settings.
- Finally, teachers we interviewed talked about the importance of the **range of leadership opportunities** BASEE/PS^3/NMTP offered them.

The design features of the professional development that teachers described as especially effective match closely to features described in academic research as indicative of exemplary professional development.[1] A sample of three (of many) reports cited in the footnote below

[1] Archibald, S., Coggshall, J., Croft, A., Goe, L. (2011). *High-Quality Professional Development for All Teachers: Effectively Allocating Resources.* National Comprehensive Center for Teacher Quality. www.gtlcenter.org/sites/default/files/docs/HighQualityProfessionalDevelopment.pdf

Darling-Hammond, L., Wei, R. C., Andree, A., Richardson, N., Orphanos, S. (2009). *Professional Learning in the Learning Profession: A Status Report on Teacher Development in the United States and Abroad.* The National Staff Development Council. www.learningforward.org/docs/pdf/nsdcstudy2009.pdf

Loucks-Horsley, S., Stiles, K.E., Mundry, S., Hewson, P.W., & Love, N. (2003). *Designing Professional Development for Teachers of Science and Mathematics.* Thousand Oaks, CA: Corwin Press, Sage Publications.

identify the following features, all of which the BASEE/PS^3/NMTP projects exemplified according to teachers:

- Provides sustained and intensive professional development (50+ hours)
- Promotes collaborative approaches; builds strong relationships among teachers
- Connects to classroom practice
- Focuses on teaching and learning specific academic content.

BASEE/PS^3/NMTP professional development experiences created and supported a cadre of teacher leaders in becoming science champions

The programs taught participating teachers about leadership in two important ways. First, they modeled exemplary professional development practices. In particular, the discussion, reflection and inquiry processes that characterized BASEE/PS^3/NMTP events were cited frequently as key components of a leadership style teachers hoped to emulate. Second, they provided explicit leadership training whereby dozens of teachers were given tools and encouragement to take on leadership roles in their home contexts. We collected a large inventory of examples of teacher leadership, ranging from formal to informal roles and responsibilities, situated in a spectrum of venues.

Through our studies of other programs over the past three decades, we have learned that teacher leaders are developed via a dynamic and synergistic cycle of learning, teaching and leading—processes that are mutually influential and beneficial.[2] This theory of professional development postulates that teacher leadership capacity building is based in classroom teaching practice and driven by opportunities to learn, which in turn inspire teachers to improve their teaching and to share what they have learned with others. It is an altruistic model of teacher growth and development. It is a model that is surprisingly simple in outline, and, in our experience, surprisingly difficult to achieve. Key to its success are two critical elements: 1) respect for and trust in teachers, as well as 2) long-term relationships with teachers. BASEE/PS^3/NMTP had both.

A convergence of contextual factors severely diminished what BASEE, PS^3 and NMTP achieved

In spite of the successes of the BASEE/PS^3/NMTP efforts, in 2008, as the PS^3 came to an end and as the NMTP got underway, powerful contextual factors converged to contribute to "a perfect storm," wiping out or severely damaging much of the important infrastructure and supports for science education that the programs had steadily developed in the previous decade.

- First and foremost, the nation as a whole faced a full-scale recession. The South Bay Area, especially Silicon Valley, was very hard hit. As a result, school districts were faced with large budget deficits and many were forced to slash their services.
- At the same time, federal education policy through the No Child Left Behind (NCLB) legislation drove increasing focus on state level academic testing through the California

[2] Heenan, B. (2009) *Reflections on the Success of NWP Teacher Leadership: A Dynamic Cycle of Teaching, Learning and Leading*. Inverness Research. www.inverness-research.org/abstracts/ab2009-03_Rpt_NWP-TeacherLeadershipEssay.html

Standards Tests (CST), and reporting through the Standards Testing and Reporting (STAR). Coupled with various "accountability" policies such as the threat of a Program Improvement (PI) designation for failing test scores, these circumstances led to schools and districts feeling tremendous pressure to concentrate exclusively on the teaching of basic skills, reading and math. Science, along with other "elective" subjects, was relegated to the instructional back burner, and in some cases at the elementary level disappeared completely.

- Change and churn in district level leadership left the efforts adrift. Many of the administrators who had been key supporters of the BASEE/PS^3 initiatives either retired or moved away to other districts or positions as budgets tightened and conditions worsened.

There are assets that remain and "the pendulum is swinging back"

Notwithstanding the unanimous agreement among teachers and administrators we interviewed that the robust and multi-dimensional science programs their districts had boasted during the lifetimes of BASEE/PS^3/NMTP no longer existed, they pointed to some important residuals:

- In most of the districts, the **science kits and materials are still in place** and are being used by elementary teachers.
- In many of the districts, some **system for maintaining and refurbishing the kits and materials still exists**.
- A **tradition of teaching science kits** remains in elementary schools in many of the districts, as well as a **heightened propensity for teaching science**.
- **Cooperation and relationships among the districts** that had previously collaborated extensively remains, though to a lesser degree.
- **Many teachers who were involved in BASEE/PS^3/NMTP are still teaching** in the districts. They have benefited from past, but nevertheless intensive, professional development as well as many accumulated years of good science teaching in their classrooms.
- In addition, a **pool of latent, currently untapped teacher leadership** for science education still exists in the districts.

These remaining assets offer still-extant capacity developed through the long-term funding afforded by BASEE/PS^3/NMTP—capacity that could be tapped in service of a what we learned is a current resurgence of interest in K-8 science education. The resurgence is fueled by several converging factors:

- Many districts' efforts to remedy the inequities among schools that resulted from the repercussions of state and federal imperatives to improve student math and reading scores
- The emergence of the Common Core State Standards (CCSS) and the Next Generation Science Standards (NGSS), encouraging many districts to turn their attention back to science because both sets of standards call for teaching higher-level cognitive skills and processes, which science inherently addresses

- California's improving education finances, coupled with districts' realization that the many thousands of dollars they themselves invested in science education in the past are assets that could be restored and to do so would be a fiscally sound strategy
- The presence of several large grant-funded STEM improvement efforts underway in the Bay Area, in which some of the BASEE/PS^3/NMTP districts and teachers participate and that "keep the flame alive" by maintaining interest in and support for science.

Our Recommendations to Funders

In the immediate future

With the uptick in both the economy and the policy environment, as well as with the appearance of the Common Core State Standards and New Generation Science Standards to which districts are responding, the implication for funders, especially local funders, is to invest now. Local external funding can make a huge difference when the conditions are favorable, and the pendulum is now swinging back towards an increased interest in science education improvement. Funders can now take advantage of the affordances that exist as remaining assets accrued from the many years of previous investment.

A long-range perspective

It is not reasonable for funders to expect that their temporary infusion of dollars into turbulent systems will create "permanent fixes" or even long-lasting institutional change. As we have seen not only from this retrospective study, but from a myriad of other investments we have studied over the past thirty years, the systems are too unstable, and the churn of federal and state policies is too great to allow for institutionalization and ongoing support for programs put in place by external funding. At all levels there is rapid, almost constant turnover in people. There is an equal tempo to the pace of changes in policy-level priorities and goals that regularly shift the dialogue, the definition of students' improvement and success, as well as the reward structure. Hence, we think that funders should focus on the following three ideas:

1) Consider investment over the long-term, not in 2- or 3-year increments. Spanning 15 years, the BASEE/PS^3/NMTP stream of monies for science education improvement showed how continuous support can reap very strong benefits in capacities, or capital, achieving sufficient durability to weather lean and unpropitious times.

2) Funding can be most effective when focused on creating supportive environments for improvement, hence our belief that all levels of the system should be addressed, but **without the expectation** of permanent change. Rather, funding should be given **with the expectation** that systems will always be in flux, and that strong leaders in a supportive state, district, and/or school environment will be able to continue to work as change happens for the improvement of science education.

3) Aiming funding toward creating the capacity for ongoing improvements in instruction, largely through the development of teacher leaders and the networks that can connect them, actually

does result in an ongoing process of local improvement. BASEE, PS^3 and NMTP serve as proof positive of this assertion, showing us how changed views and practices reside within individuals, remaining as a long-lasting capacity. Supporting teachers and others in experiencing a dynamic, self-perpetuating cycle of professional learning, teaching and leading enables individuals to become science champions, to continue to promote and enact good science teaching and learning in whatever situations or circumstances they find themselves.

A complete version of this report, Teachers As Science Champions, with a focus on how teachers' learning, teaching and leading was influenced by BASEE, PS^3 and NMTP, is available online from Inverness Research by clicking the link here.

Inverness Research, a national education evaluation and consulting group headquartered in Northern California, has over 30 years of experience studying local, state, and national investments in the improvement of education.

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