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ABSTRACT

Since its inception in 1982, the California Mathematics Project (CMP) has sought to develop the mathematics skills and leadership capabilities of K-12 teachers through intensive summer institutes and a variety of academic year programs sponsored by regional CMP sites. This chapter focuses on ways in which one of the fifteen regional CMP sites, the San Joaquin Valley Mathematics Project (SJVMP) facilitates and supports the development of mathematically competent, professionally knowledgeable, and actively involved teacher leaders. To provide a meaningful context for discussing the SJVMP, the chapter first provides a brief historical overview of the educational and political environment within which the CMP was established and in which it developed and flourished during its first 15 years. (Contains 37 references.) (Author/MVL)

8 Teacher Leadership Development as a Critical Component of Systemic Reform: the San Joaquin Valley Mathematics Project

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Since its inception in 1982, the California Mathematics Project (CMP) has sought to develop the mathematics skills and leadership capabilities of K-12 teachers through intensive summer institutes and a variety of academic year programs sponsored by regional CMP sites. This chapter focuses on ways in which one of the fifteen regional CMP sites, the San Joaquin Valley Mathematics Project (SJVMP), facilitates and supports the development of mathematically competent, professionally knowledgeable, and actively involved teacher leaders. To provide a meaningful context for discussing the SJVMP, the chapter first provides a brief historical overview of the educational and political environment within which the CMP was established and in which it developed and flourished during its first 15 years.

California's Decade of Systemic, Progressive School Reform

In 1983, *A Nation at Risk* was published, stimulating a national effort to improve K-12 education. By the mid-1980s, California's Department of Education–rallying under the enthusiastic leadership of State Superintendent of Public Instruction Bill Honig–had initiated the establishment of a coordinated, systemic reform of curriculum, instruction, assessment, and professional development. For the next decade, California was widely viewed as a leader in progressive education. The major elements of California's systemic reforms are described below, with an emphasis on the professional development component and with particular focus on mathematics.

Curriculum and Instruction

Between 1985 and 1992, curriculum frameworks were developed and published by the California Department of Education for each

of the subject matter areas required for high school graduation. Each of these guides was influenced by research, professional judgment, and documents produced by professional organizations such as the National Council of Teachers of Mathematics. The frameworks promoted "critical thinking and conceptual understanding; problem solving based on real-life problems; meaning-centered rather than memorization-oriented learning; active learning and activity-based instruction; contextualized learning which makes connections to students' experiences; collaborative learning in groups, and interdisciplinary learning" (Intersegmental Coordinating Council, 1993, p. 3).

In 1991, the California Department of Education sponsored the development of *Seeing Fractions*, the first of a number of mathematics "replacement units" designed to (a) provide an example for textbook publishers of curriculum aligned with the 1992 *Mathematics Framework* and to (b) provide teachers with the first of many *Framework*-aligned units to replace or supplement chapters in current mathematics textbooks. The state also sponsored numerous workshops throughout California to familiarize 5th-grade teachers with *Seeing Fractions* and with the new instructional expectations contained in the new *Mathematics Framework*. Curriculum writing flourished during the early 1990s. Numerous replacement units and integrated high school mathematics courses were developed—all focusing on promoting students' mathematical reasoning and understanding, and all incorporating hands-on activities, technology, problem solving, writing, performance assessment, and collaborative learning. A number of teacher leaders were involved in the writing, field testing, and implementation of these curricular units/courses. Materials approved during the 1994 California K-8 mathematics textbook adoption featured many innovative curricula that were developed in accordance with the Instructional Materials Criteria included in the 1992 *Mathematics Framework*.

To complement the new subject matter frameworks, four seminal reports covering the K-12 grade span were produced by task forces convened by the California Department of Education (CDE): *Here They Come, Ready or Not!* (1988); *It's Elementary!* (1992); *Caught in the Middle: Educational Reform for Young Adolescents in California Public Schools* (1987); and *Second to None: A Vision of the New California High School* (1992). These documents (available from http://www.cde.ca.gov/cdepress/presource.html) promoted a "rich, meaning-centered, thinking curriculum," emphasizing reform

initiatives such as developing "students' higher order thinking skills... [as opposed to utilizing] the conventional linear lockstep approaches" (Intersegmental Coordinating Council, 1993, p. 21). Teacher networks (e.g., the California Alliance for Elementary Education and the California High School Network) supported the dissemination, application, and implementation of the reform ideals presented in these documents.

Assessment

Another component of the state's systemic reform efforts was the development of a new assessment system aligned with the progressive tenets of the curriculum frameworks. In 1991, Senate Bill 662 (Hart) established the California Learning Assessment System (CLAS), replacing the California Assessment Program (CAP). State Superintendent of Public Instruction Bill Honig believed that the new performance-based test would create opportunities for students to demonstrate their understanding of the subjects tested rather than assessing how well they could guess on a traditional multiple choice test. From 1991 to 1993, CLAS developed and field-tested the mathematics, science, history–social science, and English–language arts tests for grades 4, 5, 8, and 10. The mathematics portion incorporated open-response items and a relatively small number of multiple choice items designed primarily to assess a student's conceptual understanding, number sense, and ability to solve application problems, as opposed to his or her computational proficiency. In 1993 and 1994, thousands of teachers received instruction on how to use and design rubrics to assess the open-response items on the CLAS tests (and similar assessments). In 1994, over 3000 teachers scored more than three million pieces of student work. Many teachers considered the CLAS instruction to be an extremely important and enlightening professional development experience. The focus on analyzing students' solutions to nonroutine problems provided teachers with insight into their students' reasoning and their understanding–or lack of understanding–of mathematics concepts. (The assessment system was not without controversy, however, especially from proponents of a more traditional accountability system. In September, 1994 Governor Pete Wilson vetoed a bill that would have authorized the continuation of CLAS, thus eliminating the program.)

Professional Development–The California Subject Matter Projects

The final element of California's systemic reform plan in the 1980s and early 1990s was the establishment of a statewide professional development system to provide a coordinated approach to staff development and to build teacher capacity to implement the pedagogy and content of the curriculum frameworks (Carlos & Kirst, 1997). This professional development system became known as the California Subject Matter Projects (CSMPs).

CSMP history (1981-1998). The original model for the CSMPs was the Bay Area Writing Project (BAWP), which held its first summer institute in 1974 at the University of California, Berkeley. This institute drew together expert teachers from all grade levels to examine critically the research on writing, to practice and hone their own writing skills, and to share their most effective techniques for teaching writing (University of California Office of the President, 1994). In 1981, funding was provided by the California legislature to establish a statewide network of sites based upon the BAWP model, creating the California Writing Project (CWP). The following year, the University of California supported legislation (SB 424) that instituted the California Mathematics Project (CMP). By the end of 1983, eight regional CMP sites had been established (California Postsecondary Education Commission, 1986).

In 1987, a state-commissioned evaluation of professional development concluded that in general there was little coherence or systematic planning in the inservice education that teachers received in California, and that staff development was fragmentary and tended to support traditional school structures and teaching strategies (Little, Gerritz, Stern, Guthrie, Kirst, & Marsh, 1987). The report named two notable exceptions—the CWP and the CMP, which were recognized as containing program elements that led to significant changes in teachers' thinking and practice.

In response to this study, legislation was proposed and passed in 1988 (SB 1882–the Professional Development Act) that established five more California Subject Matter Projects for subjects required for high school graduation. A fiscal augmentation in 1992 led to the expansion of existing sites, the development of new sites, and the creation of two new CSMPs for a total of nine projects (Arts, Foreign Language, History—Social Science, International Studies, Literature,

Mathematics, Physical Education—Health, Science, and Writing). The goal (though rarely met) was to establish sites throughout the state so that no California teacher would have to drive more than 100 miles to attend CSMP-sponsored activities. A recent report (Inverness Research Associates, 1998) noted that the CSMPs "provide direct support to over 67,000 teachers every year" and that "one-fifth of all California teachers are involved in at least one Subject Matter Project each year."

CSMP goals. The CSMPs have been administered by the University of California under the direction of a Concurrence Committee since 1988. In 1990, this committee developed a set of guiding principles for all of the projects. In summary, projects were expected to (a) use a "teachers teaching teachers" model, where instructional and content expertise was shared among participating teachers; (b) hold 2-4 week summer institutes and a series of academic year follow-ups focusing on subject matter content and the latest ideas in the discipline and their classroom applications; (c) foster and sustain teacher leadership by supporting curriculum development and article writing, encouraging leadership in regional and statewide professional associations, providing guidance in grant development and research, and providing and promoting opportunities for leadership at the project site and on school, district, county, and/or state curriculum and instruction committees; and (d) maintain a regional, discipline-based network consisting of K-12 teachers and college/university faculty (Bartels, 1990; Intersegmental Coordinating Council, 1993).

A major aspect of the CSMPs, therefore, is to develop and sustain subject matter area *teacher leaders*. Bohlin (1999) has characterized teacher leaders as those teachers who have made a commitment to improving their knowledge of [a particular subject matter area] and exemplary instructional practices and actively engage in helping other teachers to do the same. Little (1988) has stated that "it is increasingly implausible that we could improve the performance of schools...without promoting leadership in teaching by teachers" (p. 78). Accordingly, a recent survey of the CSMPs stated that these "teacher leaders are the horsepower for educational reform," serving in seven primary roles: (a) workshop presenters in schools and districts, (b) members of school site leadership teams, (c) leaders for local school restructuring efforts, (d) district or state-designated mentor teachers, (e) team teachers or peer coaches in their schools, (f) subject matter specialists for local schools, and (g) curriculum

developers for schools and districts (Stokes, Hirabayashi, & St. John, 1998).

The California Mathematics Project. The CMP network is comprised of fifteen regional sites based at either a University of California or a California State University campus. Faculty members serve as the sites' Principal Investigators, with a majority also serving as Project Directors. Each regional site is expected to provide leadership in mathematics education to the K-12 schools located in the site's service area. This goal is primarily accomplished through the development of a cadre of teacher leaders with the knowledge, confidence, and skills to provide leadership at their school sites and in their districts.

Although each site is uniquely administered and defines its own goals and objectives, all sites subscribe to a set of common beliefs–e.g., the importance of mathematics competency; the belief that all teachers are capable of becoming more knowledgeable, confident, and competent mathematics educators; the belief that teachers have the capacity for leadership and must play a central role in leading efforts to improve education; and the vision of mathematical power for all students (California Mathematics Project, 1994). Sites "create a professional home for teachers that is based upon a culture of inquiry, experimentation, and reflection" (Medina & St. John, 1997, p. iv) that extends throughout the life of the project. Each CMP site hosts a two- to four-week initial summer institute for an average of 30 new participants, and most sites also sponsor a "Tier II" leadership institute for project "alumni." A variety of academic year follow-up experiences (e.g., study groups, action groups, workshops, conferences, and electronic networks) nurture the development of teacher leadership among site participants. The CMP model is one of long-term, sustained professional development, in contrast to a conference or a "one-shot" workshop. Experienced and interested teacher leaders often assume leadership roles at the Project site, becoming site co-directors, institute coordinators, study group leaders, regional coordinators, or institute instructors. They are also given many opportunities to assume local, regional, and/or statewide leadership roles in mathematics education via involvement in professional organizations (e.g., the California Mathematics Council and its affiliates) and in activities related to the state's curriculum, instruction, and assessment initiatives.

This paper has provided a brief summary of California's progressive reforms of the 1980s and early 1990s with a focus on the California Subject Matter Projects. The next section provides a more in-depth look at one site of the California Mathematics Project–the San Joaquin Valley Mathematics Project (SJVMP)–to examine how that site develops and sustains teacher leaders. Quotations from Summer Institute journals and from post-Institute assessments are woven into the description to help paint a picture of the SJVMP experience from the perspective of participating teachers.

The San Joaquin Valley Mathematics Project

The San Joaquin Valley Mathematics Project is based at California State University, Fresno (CSUF), and serves teachers from five counties throughout California's Central Valley—a vast 22,405 square mile agricultural area consisting of 162 school districts, over 700 schools, and over 350,000 students who collectively speak over 100 different languages. Initial funding for the SJVMP was received in 1988. The staff consists of (a) a Project Director/Principal Investigator and two Co-Principal Investigators who are CSUF faculty members, (b) a Coordinator of Professional Development, (c) three Regional Coordinators, and (d) twelve Grade Level Leaders. All of the non-university staff are classroom teachers or curriculum specialists who have assumed leadership positions in the Project after being involved with the Project for at least a year. (More details may be found in the section on Academic Year Support.) The sections that follow provide details about the Summer Institutes and the academic year support for participants, with a focus on the ways the SJVMP helps to develop teacher leadership.

Initial Summer Institute

Each year since 1989, approximately thirty-five K-12 teachers and administrators have applied for and been accepted to participate in the two-week SJVMP Summer Institute and in a variety of follow-up experiences. Due in part to the geographic expansiveness of the service area, the first week of the Summer Institute is residential, a model that has proven to be especially powerful in facilitating professional growth and for developing close, supportive collegial relationships. The second week of the Summer Institute is nonresidential. Participants commute to a site near the geographical center of the SJVMP service area for five full-day sessions.

The two-week Institute is the first experience teachers have as formal members of the SJVMP. This Institute, particularly the residential component, provides a crucible within which teachers (a) examine and reflect critically on their teaching practice and their beliefs about teaching and learning (journal writing is an important element in facilitating reflection during the week), (b) gain a deeper understanding of mathematics concepts and how those concepts span the K-12 spectrum, (c) learn new approaches and techniques for helping their students develop a deep understanding of mathematics concepts and procedures, and (d) form close, supportive collegial relationships. It is an intense week that a participant referred to as "total math immersion."

It is also an opportunity for members of the SJVMP staff to hone their leadership skills. The Institute is traditionally coordinated by the Project Director and planned in detail with the Project staff (3 faculty and 16 teacher leaders). Staff members who have participated in the planning and delivery of previous institutes serve as mentors for any new staff members, teaming with these new leaders to plan and deliver sessions at the Institute. Each staff member is expected to actively participate in at least three days of the Institute. Pooling resources, information, ideas, experiences, and expertise during the planning of the Institute and follow-up activities is an excellent professional development opportunity for both the university faculty and the teachers on the staff.

Residential Component

The residential week is held at a retreat center near Yosemite National Park from noon on a Sunday in June or July through the following Friday afternoon. Residential institute days typically stretch from 8:00 a.m. until 9:00 p.m., with three one-hour breaks for meals, reflection, and walks. The retreat setting allows participants a rare opportunity to "get away from day to day responsibilities and 'chaos' and focus on mathematics." A variety of experiences are provided to instruct, challenge, and support participants.

Morning K-12 sessions. During the mornings, participants work in heterogeneous grade-level groups facilitated by SJVMP staff teams. They pore over professional documents such as *Everybody Counts* (National Research Council, 1989), the NCTM *Standards* documents (National Council of Teachers of Mathematics, 1989, 1991), the *Mathematics Content Standards for California Public Schools*

(http://www.cde.ca.gov/board/mcs_intro.html), and the two most recent versions of the California *Mathematics Framework* (CDE, 1992, 1999: http://www.cde.ca.gov/cilbranch/eltdiv/mathfw.htm). Issues are raised, discussed, and debated. Equity and access concerns are infused into these discussions.

During the morning sessions, participants also experience mathematics as learners and as problem solvers in a collaborative setting. Professors pose open-ended problems and investigations that serve to illustrate how numerous mathematics concepts can be embedded in the exploration, solution, and extension of a seemingly simple problem such as "How many squares can be formed on your geoboard?" or "How can you determine the height of one of the redwoods in this grove, and approximately how many cabins could you construct from it?" In debriefing, participants are amazed at the variety of solution strategies (and sometimes unique interpretations) presented by their peers, as well as by the number of mathematics skills and concepts that can be embedded in one problem. In addition, working in heterogeneous K-12 groups allows participants to (a) acquire a broader perspective of common issues and challenges that permeate all levels of education, (b) develop a greater understanding of and respect for teachers at all grade levels, and (c) become knowledgeable of how mathematics concepts are developed across the grade levels, as evidenced by one 9th grade teacher's comments:

> *One of the most amazing realizations I had this week was how factors and products could be demonstrated visually/ physically using base ten blocks (for whole number products) and algebra tiles (for products of variables). I had tears in my eyes as I finally understood—could SEE—the relationship between partial products in the multiplication algorithm and 'FOIL'! The fourth-grade teacher at my table and I felt a new connection in what we were teaching students...5 years apart!*

Afternoon grade-level sessions. At least four hours each afternoon are spent in "Grade Level [K-2, 3-5, 6-8, and 9-12] Homes" where teachers can focus on the mathematics content and pedagogy for their particular grade level. The pair of lead teachers (SJVMP staff) who coordinate each "home" create an inviting environment in a break-out room equipped with tables, chairs, a video player, and white boards. Each room is filled with a plethora of professional books,

curriculum units, manipulatives, and student projects. The Grade Level Homes provide participants with the opportunity to dialogue in depth with other teachers at their grade level and to engage in a wide variety of hands-on activities to gain a deeper understanding of mathematics concepts and ways of teaching for conceptual understanding.

In the Grade Level Home, model lessons are taught by one of the lead teachers and debriefed by the other lead teacher who demonstrates peer coaching techniques. Participants then practice teaching the concept to a partner, who critiques the lesson. Mathematics concepts that are taught at participants' grade levels (and 2 years beyond) are explored in depth. Effective uses of manipulatives and technology are demonstrated and practiced. Participants discuss honestly the challenges they face in the classroom and brainstorm solutions. Videotaped case studies are viewed and children's mathematical understanding is analyzed. Participants share "best practices." The "sharing of ideas with committed, talented teachers from many different districts" is consistently mentioned in journals as being one of the most valuable aspects of the Project, as is the opportunity to tackle challenging mathematics problems in a "safe" environment where risk-taking and grappling with concepts is expected and supported.

Darling-Hammond (1998) has stated, "teachers need deep and flexible knowledge of subject matter, many representations of ideas, and strategies for connecting ideas" (p. 5). The Grade Level Homes are an effective place to build these competencies. A fifth grade teacher wrote,

> *I never had any idea what division of fractions meant or why you inverted and multiplied. It didn't make any sense that you could get a whole number from dividing fractions. Seeing how many sixths made up a half using the pattern blocks for 1/2 ÷ 1/6 was the first of a bunch of big a-ha's this week! I even called my wife and told her about it. Math does make sense—you just have to know the language and actually own the concept, not simply memorize the procedure. I'm much more confident in my ability to use my common sense to figure out math problems or even re-derive formulas. What's that word? I'm mathematically 'empowered'!*

Evening activities. After dinner, participants spend approximately two hours in their Grade Level Homes, critically analyzing a variety of mathematics curricula and aligning their own textbooks and activities

with the California mathematics content standards. This exercise helps participants to be aware of and focus on the mathematics concepts contained in the activities they utilize in their classes, thus helping to avoid "activities for activities' sake." Learning to effectively debrief lessons with their students through probing questions is also an important component of the participants' leadership development experience.

After the evening sessions, participants gather to watch math-related videos such as *Good Morning, Miss Toliver* (FASE, 1993), *Mathematics–What are You Teaching My Child?* (Scholastic, 1994), and *The Story of Pi* (and others from the Project MATHEMATICS! series: http://www.projmath.caltech.edu/); to play games such as Set, Mancala, or Tri-Ominoes; to read; or to share unique skills and abilities during "talent night." Some gather for tutorials on the use of their laptops (on loan from the California Technology Assistance Project) or to surf the Web. Most engage in conversations about teaching that typically run late into the evening.

Community building. An important element of effective professional development is the fostering of a close-knit, supportive learning community. In such an environment, trust is developed and risk-taking is encouraged (Loucks-Horsley, et al., 1998). Fullan and Hargreaves (1998) refer to the importance of "interactive professionalism" in their essay on teacher change. The Summer Institute lays the groundwork for fostering a community where unanimity of purpose exists–the development of a deeper personal understanding of mathematics, a belief in the value of developing mathematical power in all students, and a desire to take more of a leadership role in mathematics education. The social networking of the teachers during sessions, meals, hikes, and late-night gatherings in the cabins fosters a deep sense of mutual respect and concern. Many strong, lasting professional friendships have been forged through late-night conversations between roommates and among those venturing out to the main meeting room during the late evening hours for fellowship and discussions over math games or videos. One participant referred with fondness to her "inspirational professional support group" in her post-Institute assessment.

A variety of more structured activities to develop a sense of community are incorporated into the first week. Each participant's photo is glued to a piece of colored construction paper and mounted

on the wall in one of the meeting areas. This "class quilt" serves as a message board where comments are surreptitiously left for "classmates." Each person has a secret "Math-Pal" and plans small surprises for him or her during the week. "Math Songs" such as "How do you solve a problem like division?" (a take-off on "How do you solve a problem like Maria?") are sung during meals. A class tee-shirt is designed each year by a participant-selected committee, ordered, and delivered on the last day of the Institute. (These shirts are often worn at follow-up activities and at mathematics conferences.) Engraved name badges with magnetic backs plus pens, note paper, and water bottles containing the SJVMP logo are provided for each participant as tangible mementos of the Summer Institute and membership in the SJVMP "family."

Non-residential Component

The second week of the Summer Institute builds upon the first. From 8:00 a.m. until 5:00 p.m. daily, participants expand their understanding of mathematics and effective teaching strategies. In addition, recognized leaders in mathematics education and SJVMP teacher leaders give presentations on a variety of topics selected to expand the professional knowledge base and professional contacts of the new SJVMP participants. These topics include the following: becoming an informed consumer of educational research, developing successful grant proposals, professional organizations and online journals, writing for publication, analyzing the components of the new state assessment system, the political landscape of K-12 math education, organizing extracurricular math programs, and opportunities for professional involvement.

Participants spend several hours in a computer lab each day learning ways to infuse technology into their curriculum and becoming familiar with Web sites important to their ongoing development as leaders in K-12 mathematics education. They learn presentation programs such as Microsoft PowerPoint and create an electronic presentation for their school site faculty about an aspect of their Summer Institute experience. Whenever possible, participants access electronic versions of documents and resource materials rather than print versions. For example, each of the three grade-level TIMSS reports, *Pursuing Excellence*, are available online at http://nces.ed.gov/timss/ . Participants delve into the report closest to their instructional grade level and discuss the findings in heterogeneous grade level

groups. This sets the stage for their viewing and analyzing vignettes of Japanese, U.S. and German classrooms from the TIMSS video project.

School sites are expected to provide participants with Internet access so they can continue professional networking and can access current information. Participants are also urged to join professional associations and to have their schools become institutional members of NCTM. To help these emerging teacher leaders and workshop coordinators develop their presentation skills, they receive and discuss books such as *Sharing Your Good Ideas: A Workshop Facilitator's Handbook* (Sharp, 1993). They practice presentations that they plan to give at their school sites on some aspect of mathematics education. In short, they prepare for their emerging roles as mathematics education leaders.

Assessment of the Summer Institute Experience

At the conclusion of the two weeks, participants often express enthusiasm about their Summer Institute experience:

> *I'm exhausted, but I don't want to go. This has been a powerful experience, both professionally and personally. What a stimulating group! I have made many new friends whom I rightly respect. I have packed my brain with hours of information.*
>
> *It was energizing to be around so many people who were excited about mathematics. I see myself more as a professional with new responsibilities to my students and my staff.*
>
> *I feel that every session and experience was a vital necessity for improving math instruction in schools. We received some powerful messages from this project and my somewhat passive attitude has been transformed into an advocate for equitable, challenging instruction in mathematics.*

They also make comments about the intensity of the experience: *"These last two weeks [at Math Camp] have been one of the best years of my life!"* Despite the intensity of the Summer Institute (perhaps because of this intensity), participants experience major shifts in their beliefs about the nature of mathematics, about themselves as learners of mathematics, and about what it means to teach mathematics. Typical comments are: *"This is the best professional development*

experience I have ever had" and *"Many people have said that the Math Project has changed their lives—now I know what they mean!"*

A secondary school teacher wrote in her journal,

> *Before I came to the project, I believed that I truly needed to be the 'sage on the stage' and had to be in control of every aspect of the math lesson. I was the expert, knowing and dispensing the most efficient way to solve every problem and to learn every concept. I expected all of my students to understand it the way I did and at my pace. During 'Math Camp,' I realized that I was losing so much by not listening to and learning from the students—how we all have such different ways of perceiving/solving problems and learning math concepts. Math is no longer a cut and dry subject for me. It can and should actually make-sense! Students should develop confidence in the 'whys' and 'whens,' not just the 'hows' and 'whats' of math. I can't wait to teach—and learn!--with new eyes and ears!*

An elementary school teacher wrote,

> *I wonder where I would be now if I hadn't felt that I was so dumb in math. Math Camp was the first time that I had experienced hands-on, minds-on learning, not just regurgitation, 'fill and drill' math. I feel so much more confident in my ability to understand and teach math. I also know that I'll never be tied to an adopted math program because I now have so many resources, including my own creative ideas. The SJVMP also gave me the confidence to pursue a master's degree in mathematics education.*

As the passages above indicate, the Summer Institute experience is highly effective in increasing teacher efficacy. Participants leave the Institute with a sense of renewed confidence in their ability to reach all students and a conviction about their ability to make sense of challenging mathematics problems. Castle and Aichele (1994) discuss the importance of teachers developing professional autonomy, a key characteristic of a reflective, professional educator and of a teacher leader. Autonomous teachers are independent, confident, informed decision makers who look for opportunities to keep current professionally and who continually construct and reconstruct what they know about teaching and learning. Their views are not necessarily

in alignment with or influenced by policy decisions (Firestone & Pennell, 1997). This characteristic is closely related to the concept of "self-sustaining, generative change"–the continued growth and problem solving of reflective teachers who make "changes in their basic epistemological perspectives, their knowledge of what it means to learn, as well as their conceptions of classroom practice" (Franke, Carpenter, Fennema, Ansell, & Behrend, 1998).

Although most teachers expressed a major shift in their sense of efficacy, professional autonomy, and beliefs about the nature of mathematics and teaching mathematics, some wrote that the Summer Institute experience was of value to them because it was a validation of what they already believe and how they conduct their classes. A finalist for the Presidential Award for Excellence in Mathematics Teaching wrote,

> *For the first time in my 17 years of teaching, I can say that I feel like a professional, not isolated in my own classroom. The greatest gift the Math Project has given me is the ability to empower myself and others. For me, it came in the form of self-belief. Once I saw that my alternative teaching approaches were OK, I began to step out and become a "teacher leader." I felt comfortable sharing ideas with others, at all grade levels.*

In short, the SJVMP Summer Institute helps to develop the leadership potential of participants by providing them with an experience that:

- challenges their perceptions about the nature of mathematics and what it means to be a learner of and effective teacher of mathematics.
- expects them to grapple with engaging mathematics problems and with knotty issues related to mathematics education together with skilled teachers from other school sites and districts.
- helps participants to develop a K-12 perspective on mathematics education issues and mathematics content.
- equips them with knowledge of the latest developments in mathematics education (curriculum, assessment, instruction, legislation, studies, publications, etc.) on the state and national levels.

- deepens their understanding of the mathematics taught at their instructional level(s).
- broadens their repertoire of effective teaching strategies and resources.
- strengthens their presentation skills (including their familiarity with presentation software), as well as their leadership and mentoring/coaching skills.
- presents them with opportunities and encouragement for becoming involved professionally.
- provides a "professional home" – a close-knit, trusted network of colleagues and friends who can provide support, feedback, perspective, and ideas.

The next step in the teachers' leadership development is their participation in academic year follow-up experiences and in a Summer Leadership Institute. Each participant is also placed on an electronic mailing list for daily updates on issues related to mathematics education.

Summer Leadership Institute

Judith Warren Little has stated that "one test of teachers' professional development is its capacity to equip teachers individually and collectively to act as shapers, promoters, and well-informed critics of reforms" (Little, 1993, p. 130). The SJVMP Leadership Institute builds upon the initial SJVMP experience to help achieve this goal. During the middle of the first week of the initial Summer Institute, interested alumni from past institutes attend a four-day residential Leadership Institute at the same retreat center as the Summer Institute. During this Institute, participants

- delve more deeply into the research on mathematics learning.
- strengthen their mathematical content knowledge.
- receive copies of and critically analyze recent articles and documents (e.g., NCTM Yearbooks, NCTM's *Principles and Standards for School Mathematics*–http://standards-e.nctm.org/, and state mathematics standards and frameworks).
- read sections from books such as Stanislas Dehaene's *The Number Sense* (1997) and Marilyn Burns' *Math: Facing an American Phobia* (1998).

- share their successes and challenges.
- continue the professional networking that is an important component of the SJVMP.

A statewide Presidential Award winner wrote that the SJVMP is "a network of professionals who support and raise each other to new heights." A districtwide Teacher of the Year wrote,

> *One truly valuable aspect of being involved with SJVMP is the on-going networking, communicating, and exchanging of ideas with other teacher leaders who aren't just complaining about the way things are, but are building a vision of how things can be.*

The Leadership Retreat kicks off with a welcoming reception and a thematic party incorporating mathematics activities and investigations to give the alumni and new participants a chance to mingle. Then the alumni are given the opportunity to share what participation in the SJVMP has meant to them on a personal and a professional level. The next day, a block of time is allocated for selected alumni to give presentations to new participants, who typically view the alumni as teacher leader role models and "big brothers/sisters in the SJVMP family." A participant wrote, *"It was encouraging and inspiring to hear from the alumni and know that SJVMP isn't just for 2 weeks – it's for the rest of your life!"*

Academic Year Support

Academic year follow-up activities and reunions, as well as e-mail conversations, allow collegial relationships to deepen and strengthen over time. Participants know that they have numerous trusted colleagues upon whom they can call for ideas, advice, information, or commiseration. Wertheimer's adage that "the whole is greater than the sum of the parts" is very much in evidence when talented teachers have the opportunity to brainstorm creative approaches to challenging problems or to develop ideas for conferences or workshops. It is therefore important to give teachers numerous opportunities to reconnect with members of the SJVMP "family" in both informal settings and in more formal conference/ workshop-type settings. Each gathering becomes an opportunity to reconnect, become professionally energized, gain more knowledge about mathematics and mathematics education, and grow as a teacher leader.

Follow-up Meetings and Communication

The Project's Coordinator of Professional Development oversees the delivery of a fall "Super Saturday Sharing Session" where participants from all SJVMP classes meet together throughout the day to share and discuss student work; describe new instructional or assessment strategies they have recently employed; deepen their mathematics content knowledge; and examine new research, mathematics education documents, education policies, and educational opportunities. Three additional Saturday workshops focus on curriculum alignment with the state's mathematics content standards and ways to help students meet challenging standards. Teachers, especially those who have been in the Project for a number of years, believe that an important component of the workshops is an examination of and discussion of children's thinking, reasoning, and understanding, which is consistent with the research of Gabriele, Joram, Trafton, Thiessen, Rathmell, and Leutzinger (1999).

A variety of locally-based follow-up experiences are provided by three Regional Coordinators (RCs) and each of their four Grade Level Leaders (GLLs), all of whom have been selected by the Project Director and Principal Investigators from a pool of SJVMP applicants. In addition to their roles in planning and leading the Summer Institute, each RC and his or her GLLs are responsible for the "care and feeding" of the SJVMP teachers in one or two counties in the SJVMP service area. The Project Director supports the teacher leaders (provides financial resources from the Project budget, advice, needed facilities, etc.) and meets with the teachers on at least a monthly basis. E-mail serves as an important avenue for communication among the leaders as they plan and coordinate meaningful professional development activities for SJVMP participants and for other teachers in their region.

Each Grade Level Leader is responsible for communicating via telephone and e-mail with all of the SJVMP participants in their designated county or counties who teach in one of the four grade-level spans: K-2, 3-5, 6-8, or 9-12. The GLLs offer support and resources, collect any updates on teaching assignments or addresses for the Project's database, and serve to connect participants to the SJVMP "family." The GLL also solicits ideas for needed inservices, and is responsible for planning and delivering at least three half-day mathematics workshops a year, especially targeted for teachers in

that grade-level span. These workshops are typically led by SJVMP alumni who are eager for the opportunity to develop further their presentation and leadership skills.

Each Regional Coordinator is responsible for (a) planning a full-Project reunion (consisting of a reception, meal, mathematics program, and professional updates) at a professional conference (e.g., the California Mathematics Council's Central Section conference or the Bakersfield Mathematics, Science, and Technology Conference); (b) coordinating and supporting the activities of the GLLs in his or her region, and (c) hosting an annual Administrator Evening event for SJVMP participants and their guests (principal, superintendent, and/or school board member). At these dinners, administrators are given the chance to learn more about the SJVMP and Project-related experiences of their teachers, to recognize the contributions of the SJVMP participants at their school sites, to receive updates regarding mathematics education (e.g., curriculum, assessment, pending legislation, national trends, and research), to solve mathematics problems along with their teachers, and to be recognized for their support of the Project and their teachers' leadership efforts. Each administrator leaves with a file containing information about the SJVMP, regional mathematics education opportunities, and salient articles or resources. Interested administrators also receive a computer disk containing a searchable 60-field "Professional Development Providers" database containing the names of all SJVMP teachers who are interested in delivering assistance to school sites or districts on a wide variety of math-related topics. Finally, administrators are given the opportunity to be added to the Project's e-mail distribution list to receive articles and news regarding mathematics education.

The role of the principal and other key administrators is vital "for professional development to move from learning to changes in classroom practice"(Loucks-Horsley, Hewson, Love, & Stiles, 1998), as well as for the support of leadership activities. In addition to the Administrator Evening activities, letters from the Project Director and Principal Investigators to principals thanking them for their support and requesting feedback are mailed periodically.

Online newsletter

For ongoing professional growth, it is also vitally important that members be kept apprised of the latest information and opportunities

related to mathematics education. Fullen and Hargreaves (1998) write, "redefining the teacher's role includes a responsibility to become knowledgeable about policy, and about professional and research issues in the wider state, provincial, national, and international arenas." For a number of years, the SJVMP newsletter, "Summing Up," was a key source of information for members of the mathematics education community. To provide a much more cost-efficient and timely way to share pertinent information, the SJVMP mathematics education e-mail network was born. The Project Director collects, annotates, and disseminates via e-mail articles and announcements pertaining to mathematics education, URLs of newspaper and journal articles, details of professional development opportunities, and Project member updates on a daily basis. Over half of the SJVMP teachers are part of this network, and over 400 more individuals (including curriculum coordinators, consortia directors, superintendents, professors, project directors, and interested individuals from the national and international mathematics education community) are on the expanded distribution list and receive a subset of the messages sent to SJVMP participants. Feedback from participants (and their administrators) has been highly supportive of this online newsletter, which helps to keep readers on the cutting edge of developments and leadership opportunities in mathematics education.

> *The email hotline is an incredible resource for me. The news and articles keep me amazingly well-informed. I forward the messages to key administrators in my district and also print them out and put them in a notebook that I leave in the teacher's lounge.*

> *Knowing what's happening in the wider educational arena gives me a more authoritative voice and chance to help shape the vision of the district in which I work. Being in touch with the leading edge of educational research, teaching innovation, and current events has given me the confidence to share my expertise and viewpoint in a professional way, and it has gained for me the respect and validation of my colleagues and administrators.*

Evidence of Teacher Leadership

SJVMP participants have enthusiastically commented that the Project has given them an exciting new vision as well as a

deeper understanding of mathematics content and its instruction. Teachers are implementing innovative programs of mathematics instruction in their classes and in their schools. In addition to opening participants' eyes to the world of mathematics reform, the Project is credited with providing a wide array of opportunities for professional growth. Numerous leaders in California's Central Valley credit their leadership positions and professional recognition to their participation in the SJVMP.

> *Before the Math Project, I was a really good elementary school teacher, bordering on excellent, experimenting on my own with manipulatives, problem solving, etc. But I was on my own. Very little information on good resources. Clueless about the fact that there were other teachers on the same road. Basically minding my own business. Hiding from administrators who might object to my methods. Afterwards, wow! I was a better teacher, but I also started bugging administrators for more money for math resources, leaving copies of articles and great activities in teachers' mailboxes, doing mini-inservices at teachers' meetings, applying for and getting mentorships, getting on curriculum committees and math textbook adoption committees. Because of my increased visibility and involvement, I was one of only three California teachers to be selected by NASA to attend a 2-week workshops at their Jet Propulsion Lab in Pasadena and was also named district Teacher of the Year.*
>
> *Before I became a member of the SJVMP, I was considered a strong math teacher, but I was isolated. The classroom was as far as my professional life went. The Math Project opened my eyes to a plethora of opportunities and opened dozens of doors for me! My world has expanded dramatically! My life is full of new challenges, avenues for professional growth, and dozens of new professional colleagues and friends. I guess you could say I am "professionally self-actualized!*
>
> *My SJVMP leadership training inspired me to do many more activities and unit Projects with my students; share them with other teachers at conferences; share them with my math department (which led to me being elected Department Chair at both schools at which I've taught); share them with*

thousands of math teachers through the state math journal, the ComMuniCator; share my time by being on statewide math committees, and so on.

Administrators have been highly supportive and enthusiastic about the effect of Project participation. Teachers are expected to take a wide variety of leadership roles at their school site and in their districts. Administrator surveys collected by Bohlin (1996) included the following comments:

Every teacher comes out stronger and more proficient in curriculum and assessment. The experiences empower teachers to make significant changes in their classrooms and schools.

As Director of Curriculum, I have seen four of our teachers participate in the project. They have all served in leadership roles including mentorships, math committees, presentations, Program Quality Review for math, and officers in math organizations."

C--- has gained confidence in his field. He is willing to share his knowledge with others and to move the department in the direction of the frameworks. Student interest is high.

I think that this project is wonderful. I hope to send others who will take risks in the classroom and share with others.

M---'s leadership is changing the way math instruction is delivered at this school. He is an excellent teacher who is now a teacher of teachers.

It's been a pleasure to work closely with a teacher who is now on the 'cutting edge' of mathematics instruction.

Following is a sample of recent leadership roles and professional recognitions that teachers have received in the years following their initial participation in the SJVMP:

- Four SJVMP teacher leaders have received the statewide Presidential Award for Excellence in [Elementary or Secondary] Mathematics Teaching during the past three years; three more have been finalists. Two teachers received district Teacher of the Year honors in 1999.
- A team of a dozen SJVMP teachers from Visalia Unified School District was instrumental in conceptualizing an NSF Local

Systemic Change grant that was recently funded for $3.8 million; four members of the development team are currently serving as full time lead teachers for that project.

- SJVMP teacher leaders serve in key leadership roles on the mathematics inservice team for Fresno Unified School District's (FUSD's) NSF-funded Urban Systemic Initiative; an SJVMP teacher was selected as the district's Director of Research and Evaluation.
- A team of SJVMP teacher leaders co-directed a statewide conference on equity in mathematics education.
- Three NCTM regional affiliates have been established or revitalized by SJVMP teachers.
- The immediate past-president of the California Mathematics Council (CMC) is a former co-director of the SJVMP; a number of other SJVMP teacher leaders have been elected to serve on the CMC statewide or regional boards in recent years.
- Three SJVMP teacher leaders' classrooms were filmed for the WGBH (Boston) Math Library Project.
- Over 20 SJVMP teachers have written Internet-based mathematics lessons linked to the state mathematics content standards for SCORE-Math (http://score.kings.k12.ca.us/lessons.html) and/or have written mathematics lessons to accompany instructional television (ITV) programs. Teachers involved in writing the ITV lessons provided training for other teachers at the KQED (San Francisco-based) National Math, Science, and Technology Conference in 1994.
- Three SJVMP teachers were selected as mathematics resource teachers, coordinators, and writers for a statewide online high school program, CyberHigh.
- Over 50 teachers were trained in the use of replacement unit curricula and delivered regional inservices.
- Ten to twelve SJVMP teachers serve as part-time instructors each semester for mathematics or mathematics methods courses for preservice teachers at area colleges and universities.
- Over 200 of the SJVMP participants have served as school site mentor teachers (math specialization), mathematics workshop

leaders, and/or presenters as local and regional mathematics conferences.

- Three SJVMP staff members were recently selected to be the Fresno and Tulare County Mathematics Coordinators and the regional coordinator of the California Technology Assistance Project.
- In the past several years, members of the SJVMP have served in a number of leadership roles at the state level, including service on the California Framework Commission, statewide mathematics assessment and accreditation panels, and state mathematics curriculum advisory panels.

Postscript

The above profile of the San Joaquin Valley Mathematics Project provides but one example of the effectiveness of the California Mathematics Project model in developing K-12 mathematics teacher leaders. Participants enthusiastically credit the Project with having prepared them for and supported them in their leadership roles. For many years, the vision of the CMP, site directors, staff, and teachers was consistent with the state's vision of progressive educational reform. In 1986, then-State Superintendent of Public Instruction Bill Honig observed, "There is a growing spirit of optimism and a can-do attitude among educators that I think bodes well for the future of the state and the future of the country." For members of the CMP community, this spirit of optimism has been sorely tested recently, affecting the community's strength, effectiveness, productivity, and morale.

In recent years, California has experienced a powerful, effective backlash against the NCTM *Standards*, the reform-oriented *Mathematics Framework* (CDE, 1992), and reform-oriented mathematics curricula (e.g., *MathLand, Connected Mathematics,* and the *Interactive Mathematics Program*) by individuals and groups with important political ties. For reviews and commentary, see Becker and Jacob (1998), Carlos and Kirst (1997), Jackson (1997a, 1997b), and Jacob and Akers (1999). These writers document how policy decisions regarding the *Mathematics Framework* (1999), *Mathematics Content Standards* (http://www.cde.ca.gov/board/mcs_intro.html), textbooks, and assessment were taken out of the hands of teacher leaders and mathematics educators and placed primarily in the hands of selected

mathematicians and members of the State Board of Education (SBE). The SBE recently approved a new *Mathematics Framework* (http://www.cde.ca.gov/cilbranch/eltdiv/mathfw.htm), with a more traditional focus and containing rigorous, skills-based content standards on which a new assessment system, STAR (http://star.cde.ca.gov/) is based. A recent mathematics textbook adoption (AB 2519) resulted in the approval of a limited number of traditional books that were closely aligned with the state standards (http://www.cde.ca.gov/cilbranch/eltdiv/ab2519math.htm) but considerably different from recent textbook analyses/recommendations from national groups such as the American Association for the Advancement of Science (http://project2061.aaas.org/matheval/part1.htm).

In early 1998, Governor Pete Wilson removed the California Subject Matter Projects from a draft version of his budget. Negotiations restored the projects, but under new legislation – AB 1734 (Mazzoni). This bill requires the CSMPs to use the state content standards as the principal reference point for CSMP-sponsored professional development activities. Mathematics content is to be the primary focus of California Mathematics Project institutes and follow-ups. CMP sites must form partnerships with low-achieving schools and provide mathematics instruction for these schools' teachers. The test performance of students in the partnership schools is to be monitored and used as one of each project site's accountability measures.

Following the introduction of AB 1734, CMP sites were required to reconceptualize their programs and submit proposals in accordance with the new legislation. Only 11 sites out of the 17 that had been in operation for nearly a decade received funding for 1998-1999. Fifteen of the 19 sites that submitted proposals in 1999 (13 of the original sites) were funded for 1999-2000. In late 1998, the entire staff of the Executive Office of the CMP resigned, and as of August, 1999, a permanent Executive Director had not yet been named.

The next few years will be a time of reflection, reconceptualization, and rebuilding for the California Mathematics Project. The former CMP model embraced and built upon the tenets of a progressive mathematics reform movement, which was supported by and consistent with existing statewide policies for curriculum, instruction, and assessment outlined in the opening pages of this chapter. Teacher leaders (and teacher educators) were actively involved in curriculum development and assessment; they were part of the decision-making process, an important element of teacher leadership.

The new CSMP model, under AB 1734, is consistent with the current statewide focus—one that does not embrace the tenets of the reform movement, but instead focuses on a more traditional skill development/assessment model where teachers' professional involvement and decision-making opportunities are more restricted. The former CMP model was highly successful in developing a thriving statewide cadre of enthusiastic, knowledgeable, professionally-involved teacher leaders for K-12 mathematics. The CMP also provided a productive professional network for university mathematicians and mathematics educators who were involved as Project Directors and Principal Investigators. The capacity of the "new CMP" to recapture the momentum and success enjoyed by the "old CMP" is difficult to predict. The final story of the California Mathematics Project will be a revealing study of how two contrasting models compare in their effectiveness in developing and sustaining K-12 mathematics teacher leaders.

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