Assembling a Good Team:
Teacher Learning from Professional Development

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Michigan State University

A Final Report to the Noyce Foundation

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Nicholas Fiori
Juliet Halladay
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Executive Summary

Part 1: Introduction

If teachers are the critical component in improving U.S. education, then high-quality professional development is another essential component of instructional reform. In response to increased criticism of traditional models of professional development, new models have emerged. However, the effects of these new models remain largely untested. Thus, the need for improvements over traditional professional development models carries with it a need for research on the reform models that serve as their successors.

This report summarizes the results of the Noyce Foundation’s independent research into the effectiveness of its own professional development efforts. It addresses the following broad research questions: Does the Noyce Foundation’s investment in professional development make a difference? If so, in what ways? In describing the effects of the professional development programs in question, we focus primarily on teacher learning, although we are also concerned with the ultimate outcome of student learning.

We begin by reviewing the relevant research literature on professional development and teacher learning. We then describe the two professional development programs under investigation and present findings based on patterns revealed in the various data sources. Data are interwoven with illustrative cases of teaching practice. Our data lead us to a detailed discussion of factors that appear to influence the ways that instructional reforms are implemented in classrooms. Finally, we close with a summary of lessons learned and a set of recommendations and implications for future research and practice.

Part 2: Review of the literature

The current climate of educational reform favors curriculum standards, high-stakes assessment, and accountability, with teacher quality seen as critical to the success of reform efforts. In this climate, teachers are being asked to make substantial changes in their instructional practice by examining – and often transforming – their core beliefs, knowledge, and habits.

In order to effect these deep changes in their practice, many teachers encounter opportunities to learn through their participation in professional development programs. The traditional model of presentations by outside experts has come under attack by those who favor a more integrated approach to professional development. Where professional development programs have traditionally offered disconnected in-service training sessions, professional development reform calls for integration, contextualization, and inquiry, all grounded in the actual work of teaching. In such programs, teachers participate in a cohesive set of novel learning opportunities. This reform model aims to take advantage of the learning that occurs in and from teachers’ daily practice by designing learning opportunities that help teachers adapt instructional reforms to fit their individual classroom contexts.

However, despite the emerging consensus that the reform model is an improvement over the traditional paradigm of professional development, there is currently scant research to defend the ability of such programs to foster teacher and student learning. It is in this context that the Noyce Foundation has worked to develop professional development programs that embody many of the elements of the reform paradigm and to establish empirical evidence of their effects. This section of the report reviews the relevant research and theoretical literature on professional development reform and notions of teacher learning.
Part 3: The Noyce Foundation’s Investment in Professional Development: The Silicon Valley Mathematics Initiative and Every Child a Reader and Writer

Here, we offer detailed descriptions of the two professional development programs sponsored by the Noyce Foundation which are the focus of this research: Every Child a Reader and Writer (ECRW) and the Silicon Valley Mathematics Initiative (SVMI). These descriptions encompass the structure and process of each program, as well as the guiding principles and theory of action that undergird them both. In particular, we learn more about the ways that writing and mathematics are defined and put into action – the Noyce definition of ‘good teaching’ in both of these subject areas. This section also gives readers a feel for what participation in the programs might be like for teachers.

We also include some preliminary findings in terms of student and teacher learning, making the case that these programs are worthy of learning from and being used as models because of their apparent positive effect on student learning. Although student data are not entirely conclusive, both ECRW and SVMI appear to have positive effects on some measures. In particular, participation in ECRW appears to have marked positive effects on students who have been in the program for two or more years. And SVMI students perform as well or better than comparable non-SVMI students on certain assessments.

In our discussion of ECRW and SVMI, we find that the various elements of the two programs are all united by a common set of beliefs, values, and pedagogical ideas. This section articulates the following core beliefs:

- The methods espoused by ECRW and SVMI are effective teaching methods
- Teachers must make significant changes in practice and understanding
- Substantial, deep changes take time
- Teachers must be supported during their process of change
- Teachers, like students, learn best by doing
- Effective professional development programs and reforms must be both systematic and flexible
- There must be on-going assessment of professional development programs

The core beliefs that underlie ECRW and SVMI are related to the vision and operating principles of the Noyce Foundation. Founder Robert Noyce valued optimism, creativity, innovation, excellence, determination, commitment, patience, and flexibility. The operating principles that derive from this set of core values focus on community, content, professional development, leadership, and results.

Also in this section, we describe the theory of action that animates the Noyce Foundation’s programs. This theory of action includes the following central ideas:

- Belief follows practice
- The professional development program itself must change and be responsive
- Sustainability comes from developing expertise and leadership
- Actors at all levels of the system need to acquire knowledge and skill
- Educational reform requires outside agents who will help schools build infrastructure and capacity

Part 4: Methods

This section of the report describes the research project we undertook at the request of the Noyce Foundation. Our central purpose was to find out whether teachers
were learning from the programs, and if so, what they were learning. This research was intended to provide evidence to the Noyce Foundation, contribute to the larger base of research on teacher learning and professional development, and add to theory-building about professional development reform.

To this end, we gathered data related to the following set of research questions:

- **What opportunities do teachers and coaches have to learn in these professional development programs?**
- **What do teachers learn about mathematics or writing, students and their learning, and instructional strategies from these professional development programs? How does their relationship with mathematics or writing change?**
- **What program features account for this learning?**
- **In particular, what is the role of coaching? What is the role of the performance standards and assessments? The principal? What is the importance of school-wide or district-wide adoption of the program?**
- **What behaviors do teachers and their students engage in during instruction?**
- **How do students perform on traditional and alternative measures of student achievement and performance?**

We next describe our research design, which was largely ethnographic but incorporated multiple methods, including surveys and interviews. At the program level, we observed professional development events, documented opportunities to learn, interviewed program staff, and collected relevant program documents. At the teacher level, we conducted interviews and observations of six case study teachers from each of the two programs; shadowed case study teachers at professional development events; interviewed their coaches; and conducted a number of surveys of the broader sample of teachers. At the student level, we had access to all of the data that the programs collected, usually in the form of mathematics assessments, student writing samples and scores, and scores from California’s statewide testing program.

For data analysis, we identified the teachers’ various learning opportunities and looked for the presence or absence of changes in teachers’ knowledge, beliefs, and practice, both within and across teachers. Patterns that emerged from interview and observational data were then tested with the survey data. In particular, we wanted to discover what the teachers learned through their participation in the various components of each of the two professional development programs. Having identified patterns and potential relationships in both the observational and survey data, we then used quantitative regression analyses to test the significant of the relationships between a variety of predictor and outcome variables.

Finally, we discuss several challenges we encountered regarding issues of access and methodology. One challenge was that, although our research was designed to be exploratory and descriptive, it was often viewed as evaluative. It is possible that fear of judgment may have affected both our interactions with program participants and the information we were able to obtain from them. Second, the programs’ commitment to responding to local contexts and evolving circumstances made the program more difficult to study and define. A third methodological challenge concerned the perceived conflicts of interest arising from the common funding source for the professional development program and the research study. Participants may have given answers that they felt the Noyce Foundation would regard as the “correct” answers. One final methodological challenge involved the conflicting pulls of teachers’ time in these schools. Teachers had to simultaneously follow several agendas and serve multiple constituencies.
Part 5: What Do Teachers Learn?

As mentioned earlier, the data that inform our discussion of teacher learning come from field notes, interviews, surveys, and participant feedback from professional development events. In this section, we draw on survey data to describe what teachers learn from their participation in various opportunities to learn provided by ECRW and SVMI. We then present several cases that complicate our views of what teachers learning through their participation in the two programs.

We turn first to the survey data. In particular, we discuss what the survey data tell us about what teachers learn from engaging in mathematics and writing through their participation in SVMI and ECRW. Giving teachers experiences engaging in the disciplines they teach is a common feature of the new model of professional development. This engagement is assumed to contribute to teacher confidence and subject matter knowledge. Survey data indicate that ECRW teachers reported increases in enthusiasm for the teaching of writing, interest in learning more about the teaching of writing, and appetite for reading both children’s literature and professional literature. One sees similar results for SVMI. Significant majorities of respondents reported enjoying both mathematics and teaching mathematics more. Likewise, they also reported increased confidence both with thinking mathematically and teaching mathematics, and they reported wanting to learn more about mathematics and teaching mathematics.

We next present information from our case study teachers. Based on our analysis of this data, we divide teacher learning into three domains: (1) their understanding of teaching as a practice, as well as their classroom behaviors; (2) their subject matter knowledge, including their understanding of the “what” and “how” of mathematics and writing; and (3) their understanding of teaching as a profession and its attendant obligations.

1) Understanding of Teaching as a Subject-Specific Practice and Accompanying Classroom Behaviors

One key indicator of teacher learning is that participating teachers appear to change the ways in which they think about teaching their subject. The operating principles and core beliefs of the programs each have logical correlates in terms of what kinds of student behavior are valued and expected. In other words, the programs’ philosophy translates into an expected set of student behaviors, such that there is a clear view of what constitutes ‘good’ teaching and learning of writing and mathematics.

Over time, we have noticed shifts in teachers’ practice toward the programs’ progressive goals. For example, data from the SVMI case study teachers show us that participating classrooms become places where errors are viewed as opportunities for deeper exploration of mathematics. Teachers also appear to change their ideas about the role of assessment in their teaching, using it to inform future instruction rather than applying it toward purely evaluative purposes.

Similarly, we have evidence that participation in ECRW changes the way that teachers think about writing instruction. Teachers increasingly view reading and writing as integrally connected, and writing in their classrooms occurs as a social, collaborative act. They learn to talk about teaching and learning in new ways, and their classroom practice undergoes related changes.
2) Teachers' Subject Matter Knowledge and their Understanding the “What” and “How” of Writing and Mathematics

A second shift appears to be in how the teachers think about or understand the subject matter – in this case, writing or mathematics. Both ECRW and SVMI provide teachers with significant opportunities to do mathematics and to write. In professional development activities and in the presence of supportive colleagues, teachers write, study the writing of others, and engage in mathematical explorations and discussions.

In this section, we offer a few snapshots from our case study teachers to illustrate the ways that participation in professional development activities gives teachers opportunities to deepen their subject matter knowledge by immersing themselves both in the work of writing and mathematics and in the supportive and collaborative conversations that arise from joint engagement in the discipline. In our discussion of disciplinary engagement, we describe five potential benefits that appear to accrue from teachers “doing” the subject matter:

a) Developing teachers' own writing and mathematical practices
b) Developing cognitive empathy
c) Increasing subject matter knowledge
d) Developing an appetite for future content learning
e) Developing a broader conception of the discipline, different than what is commonly represented in school

Our data in this area suggest that teachers can learn many things from professional development that engages them in disciplinary practice. However, we need to qualify this claim somewhat by pointing out that much of this learning requires teachers to first unlearn existing misconceptions. In many cases, it also takes teachers time to develop enough confidence to try out their new understandings of the subject. Also, it is important to note that much of our data comes from the teachers' own descriptions of their learning and their teaching practice. As a result, although we know what teachers said about their practice, actual changes in practice were more difficult to discern. Our classroom observations have convinced us that teachers in these programs have quite uneven levels of subject matter knowledge.

3) Understanding Teaching as Professional Work with Attendant Obligations

The third major change involves how participating teachers understand the profession and work of teaching. ECRW and SVMI both provide teachers with a range of leadership opportunities – coaches, workshop leaders, exemplar teachers – many of which they can assume without leaving their positions as classroom teachers. These opportunities, combined with the expectation of making observations of others’ teaching, leads participants to view teaching as intellectual and public work.

Survey data reveals that teachers spend significant amounts of time reading, observing, and collaborating with other teachers on professional matters. Related to this increase in time and change in activity, teachers’ ideas about professional obligations were also changing. Participants overwhelmingly described themselves as being positive about school, teaching, and their students. Teachers also positioned themselves as being interested in continuous improvement. This stance allows them to see struggles as learning opportunities.

Inside Classrooms: How Principled Ideas of Practice Take Form in Schools, or What Learning Looks Like When You Go to School
In this part of the report, we present several cases as a preface to our discussion of the factors that appear to shape the conditions under which teachers' practice changes. These cases provide insights into some of the ways that teachers enact the ideas that they draw from varied sources. Not surprisingly, our observations of case study teachers showed that there is considerable variation across classrooms.

The first case introduces readers to an SVMI teacher who has clearly adopted some of the basic methods espoused by the program. She encourages students to talk more and explain their thinking as she assists them in moving away from standard algorithms and toward a deeper conceptual understanding of the underlying mathematics. She credits her participation in lesson study activities with some of her recent learning, and she expresses her belief that students’ explanations are for other students and not just for her. However, she also guides students toward her preferred methods and records their ideas for them, all in the name of efficiency. In fact, time appears to be a significant constraint, with her desire or need for efficiency sometimes superseding the need for making sense of the mathematical concepts involved. Her participation in SVMI has given her a new curriculum, with its attendant new language, new activities, and new roles for students and teachers. However, the enactment of the program’s core principles is somewhat uneven.

The second case contrasts the experiences of two ECRW teachers, Gail and Lynn. The two teachers are similar in their adoption of surface feature of writing workshop. They follow similar lesson structures, engage in similar routines, and have many common classroom texts. However, they also differ in some significant ways. Gail does not have much pre-ECRW experience with writing workshop, and her relationship with her coach is not a close one. In contrast, Lynn has had previous exposure to writing workshop, and she pulls her ideas together from a variety of sources, some external to ECRW. She also has a close relationship with her coach. And despite the similarities in the surface structures of their writing lessons, the substance differs quite a bit. Excerpts from teacher-student conversations during writing conferences reveal striking differences. Lynn focuses on teaching the writer, not the writing, while Gail – between interruptions and classroom distractions – asks leading questions and guides her students more forcefully toward particular ends. Thus, despite similar outward appearances, the two teachers enact significant differences in the substance of their teaching conversations and in the nature of their teacher-student relationships.

The third and final case illustrates some of the difficulties associated with making deep changes in school cultures and belief systems. Through the story of “Pi Day” – one school’s celebration of \( \pi \) – we see a case in which a difficult mathematical concept is treated superficially. In designing activities to relate to \( \pi \), the school focuses either on the number’s strict value or on puns on the number’s name (e.g., pie). What begins as a mathematical celebration becomes distinctly non-mathematical. This case offers an example of an activity that is based on SVMI principles of exploring mathematical concepts but that loses mathematical value when it is put into practice.

Part 6: What Opportunities for Learning Do Teachers Participate In?

In this section, we describe the various professional development opportunities in which case study teachers engaged. Their involvement varied greatly, with individual teachers participating in different combinations of professional development opportunities. This variation is based on interest and initiative, district requirements, and availability. Because differences in participation appear to be linked to differences in learning, we looked closely at patterns of participation.

According to ECRW survey data, the most commonly undertaken learning opportunities in that program were activities close to practice, such as planning and
discussions. Also common were watching model lessons taught by coaches and exemplar teachers, discussing professional literature, going to grade level meetings, and attending outside professional development sessions. Rarest were coaching interactions and Saturday series. As we saw in the previous cases, there was also great variability in coaching, in terms of the content addressed, the mode of communication, and the strength and frequency of the coaching relationships.

The SVMI survey data tell a similar story. Many participating teachers administered MARS assessments and participated in MARS scoring sessions; less common were coaching relationships and outside professional development events. Teachers and their coaches engaged in a variety of activities together, including discussing mathematics content, finding materials, supplying lessons ideas, and co-planning lessons. Teachers report that their professional growth was impacted most by coaching and by MAC professional development, followed by summer institutes and MARS administration.

Part 7: What Factors Shape Teacher Learning?

This section of the report describes a number of factors that seem to have effects on what teachers learn and what changes they make in their teaching practice. In our analysis, we identified two clusters of factors: those related to teachers and those related to the schools they worked in.

Teacher Characteristics

In discussing the different personal resources that teachers bring to their professional development experiences, we focus on two characteristics that seem to affect their learning: (a) enthusiasms for professional development; and (b) prior (mathematical and pedagogical) knowledge and experience. In our discussion, we present case study teachers who offer helpful examples of the ways these characteristics influence their learning.

Enthusiasms for professional development. ECRW and SVMI teachers vary greatly in their enthusiasm for professional development, for the subject matter, and for engaging in continuous improvement. Their appetite for professional development appears to be an important factor in explaining why they respond differentially to the ideas they encounter in the professional development programs. To illustrate this point, we describe the cases of Maggie, an SVMI teacher, and Gail and Lynn, both ECRW teachers. Their attitudes toward their own learning and their perceptions of their learning needs affect their stance toward the professional development events in which they have opportunities to engage.

Since many teachers have been voluntary participants in ECRW and SVMI, it is not surprising that they tend to be characterized by enthusiasm for learning opportunities. However, others were more reluctant or were merely obeying administrative orders. Thus, readiness and enthusiasm for the programs and for professional development varies widely across teachers. Although many are enthusiastic implementers, there are also some resisters and skeptics, and some of these felt alienated by the programs and their philosophies.

Prior (mathematical and pedagogical) knowledge and experience. Many case study teachers expressed frustration with their limited knowledge about mathematics and writing, suggesting that they had a lot to learn about the content and teaching the content. However, it appears from our data that teachers who had previous experience with similar professional development programs or with disciplinary immersion had greater readiness for learning. They were able to implement the reforms with less support.

Teacher Learning from Professional Development
In this section, we offer some examples of teachers who exhibit different levels of readiness, and we introduce the concept of learning trajectories. This concept allows us to see that teachers enter the programs at different starting points, and they follow different paths of change as they adjust to new ideas and modify both their beliefs and their practice. Because their trajectories differ, the amount of change is relative – small changes for novice teachers can be viewed as big accomplishments.

We also discuss ways that teachers’ entering beliefs and experiences shape their learning and their practice. Since SVMI and ECRW both value and depend upon students’ ideas, teachers whose ideas about teacher-student roles favor a more teacher-centered approach may be in conflict with the program’s core values. This conflict can lead to less successful implementation. In other words, their ideas about students were sometimes in conflict with the assumptions of program staff. In addition, teachers sometimes felt trapped between the two conflicting forces of professional development reforms and curriculum demands. In discussing the effects of this conflict, we present the case of one teacher who espoused progressive ideals but enacted a more traditional model.

School Level Characteristics

A second set of factors that shaped what teachers learned in and from SVMI and ECRW concerns school variables, including: (1) policy pressures; (2) leadership; and (3) school culture.

Policy Pressures. Survey results indicate that SVMI teachers felt that state and district standards were the most significant influence on the content and instructional methods they pursued, followed by professional development and then district and state assessments. In their discussion of policy contexts, teachers mentioned two primary concerns: accountability and curriculum collision. In terms of accountability, testing pressures led some teachers to teach toward standardized tests and away from program goals. In at least one case, teachers were constrained by the adoption of a scripted program, intended to raise test scores, that conflicted with the goals and methods of ECRW. The related idea of curricular collision occurs when there is a clash between the content and pedagogical commitments of ECRW and SVMI and the official curriculum. For example, teachers found it difficult to match their ECRW teaching methods and portfolio scoring with the official writing assessments required by the district.

Leadership. A second school factor that was clearly important was school leadership. Part of the Foundation’s theory of action is a system-wide view of capacity building: change has to occur at all levels of the system in order to sustain reform. ECRW and SVMI both included opportunities for administrators to build their own leadership capacity.

And teachers cited leadership as being a critical resource for their implementation of ECRW and SVMI, with reform efforts most successful in schools where principals were ‘true believers’. The quality of administrative leadership also depended on how familiar principals were with the reform programs – whether they had in-depth knowledge of the programs or merely a surface understanding.

School culture. Participating teachers worked in a wide range of settings in terms of collegiality and shared work. Different schools had different expectations for the extent and nature of collaboration among teachers. There were also differences in the ways the coach’s role was conceptualized, with some using coaches to guide and support instruction and others using coaches more to locate and secure resources.

In describing the importance of school culture, we offer contrasting cases of two different teacher book discussion groups. These examples offer windows into the ways
that teachers’ experiences varied by school. One book group’s interactions are characterized by careful probing of the author’s intentions and discussing personal responses to the shared book. This case reveals the participants’ common beliefs about writing workshop structure, methods, and purpose. In contrast, the second case describes a book group with a more hierarchical, top-down structure, in which the primary focus is on procedural concerns.

These cases illustrate ways that school culture affects the extent to which the values of ECRW and SVMI may be enacted. For both programs, there is significant variability across school settings, some of which derives from variability in levels of support and collegiality and in norms of professional interaction.

Part 8: What Opportunities to Learn Have Greater Effects?

This section describes in detail the methods used in a quantitative analysis of teacher learning, using multiple regressions. We describe the variables we used as predictors and outcomes and present our findings in a number of areas. Because methodological and conceptual issues made it difficult for us to map teacher learning directly onto individual learning opportunities, we chose instead to create a series of multi-variable scales from conceptually similar survey items.

Method. In our analysis, we use multiple regressions to describe relationships between predictor and outcome variables. A regression model is a linear combination of predictor variables that corresponds as closely as possible to the outcome variable. This type of analysis helps us to answer questions about certain variables: What are the relationships between the variables? How strong are the relationships? Which predictor variables are most important to which outcomes? In particular, we use stepwise regressions, commonly used in exploratory studies, to try to determine which predictor variables make meaningful contributions to the target outcomes.

Scale Development. We created new variables by combining groups of survey items into scales based on similar content. These new variables were then used as outcome or predictor variables. We also used a few single survey items as outcome variables. The following sections of the report give detailed descriptions of the scale development and the independent and dependent variables for our analyses of both ECRW and SVMI.

ECRW

Based on survey responses, we developed three scales for the impact of ECRW:

- **Teacher Confidence**: teachers’ confidence in their capacity to use a broad array of instructional strategies that are both generic and specific to the teaching of writing, and their confidence in managing classrooms and student work.
- **Pedagogical Content Knowledge**: teachers’ knowledge of teaching strategies, organizational structures, and teaching/learning theories specific to the teaching of writing.
- **Learning in Practice**: teachers’ self-reported enthusiasm for trying things out in their classrooms and learning more about writing and the teaching of writing.

In addition, we ran regressions on several individual items. We had a total of six outcomes for ECRW, and we used 26 items as independent variables.

We conducted multiple regressions to determine which factors were good predictors of each of our six outcome measures. From these regressions, several important patterns emerge. First, it seems clear that coaching matters, since working with a coach is a positive predictor of several of the outcome variables. Other variables
that predict multiple outcomes are visiting other teachers’ classrooms, ECRW curriculum materials, and the Saturday speakers series. Second, teachers appear to learn more when they participate in a combination of learning opportunities, with some proximate and some more distant from classroom practice. Third, it is important to note that the regression results differ slightly from teachers’ own perceptions (reported on surveys) about what professional development opportunities matter most for their learning.

SVMI

Based on survey responses, we developed two scales for measuring the impact of SVMI: teacher confidence and teacher pedagogical content knowledge in mathematics. As with ECRW, we also ran regressions with a handful of individual items. The outcomes of interest for these analyses included two scales – teacher immersion and pedagogical content knowledge – and three single items (confidence, increased understanding, and desire to learn more about mathematics and teaching mathematics). For independent variables, we used both the breadth and depth of teachers participation in SVMI; the extensiveness of a teacher’s work with a coach; the degree to which teachers experimented with ideas and materials in their own classrooms; school climate; and principal support.

The regression analyses yielded little in the way of interesting results, so we decided to calculate Pearson correlations to assess the relationship between the SVMI variables. A Pearson correlation is a statistical measurement of the degree to which two variables are related to one another. Unfortunately, even this additional correlational analysis revealed very little of interest or surprise. However, our results do suggest that breadth and depth of participation are consistently positively related to a range of outcome variables. In addition, the extent of a teacher’s interactions with a coach is positively correlated with a number of different outcomes. Principal support and school climate did not appear as significantly related to most of the outcome measures we used.

Part 9: Toward Understanding the Complexity of Teachers’ Learning from Professional Development

ECRW and SVMI are important programs to study because they embody so much of what it currently recommended – but untested – as a reform model of professional development. Our investigation of the two programs also helps us to engage in theory-building about teacher learning and the circumstances that shape it. In this section, we summarize some of our key findings about the complexity of teacher learning in the context of comprehensive professional development programs like ECRW and SVMI. We then turn to a brief discussion of methodological issues and implications for future research and practice of professional development.

Teachers Learn. One primary reason the programs are important is because teachers did learn. Our various data sources and analyses combine to paint a picture to teachers who have shifted in their understanding of teaching as a practice, expanded their subject matter knowledge, and altered their sense of teaching as a profession. They changed their understanding of what it means to ‘do’ writing and mathematics, and they experienced a resultant confidence in their ability to do and teach the disciplines.

Teachers’ Learning Varied. As mentioned earlier, the nature and extent of teacher learning based on a variety of teacher- and school-level variables. It also depended in part on program-specific variables, such as coaches’ expertise, instructional content of professional development sessions, and helpfulness of program materials. However, because of the responsive nature of the programs and their resulting state of continuous change and improvement, we were unable to collect systematic and longitudinal data on
these program-level variables. Based on the case studies and survey data, though, we
can make two key observations about the variability in teachers’ learning.

_**Coaching matters.**_ Coaching was related to changes in teacher knowledge and
practice. However, the effects of coaching were inconsistent because of significant
variability in the frequency, intensity, substance, and even the mere existence of
coaching relationships. Not surprisingly, we found that teachers who worked with
coaches learned more. In many cases, though, since coaching was the most resource-
intensive part of the programs, ECRW and SVMI both ended up rationing coaching
resources so that attention was focused on novice teachers. This corresponding lack of
attention to more experienced teachers often meant a lack of continued growth in the
program.

_**Mixing it up matters.**_ Another important finding is that teachers who participated in
a combination of opportunities to learn appear to have learned more. As mentioned
earlier, effective mixtures of learning opportunities included events located both within
practice and distant from practice. In addition, some essential components of effective
mixtures appear to be cornerstones of traditional models, such as guest speakers. The
cohesive integration of traditional activities with more progressive components like
coaching and observations of exemplar teachers seems to be particularly effective.

**The Conceptual Complexity of Teacher Learning**

Our results in many cases may seem to be summarizable as “it depends.” While this
equivocation might be unsatisfying, the results point out some complexities of
professional development, which manifest themselves as distinct challenges for
researchers and policymakers.

In this section of the report, we outline five areas of complexity.

- **Breadth of teachers’ participation.** Understanding the impact of professional
development on individual teachers depends on knowledge of their
involved in both the depth and breadth of program components.
- **Within program variability.** Even when teachers engaged in the same program
components, they did not have identical experiences. For example, even though
many teachers engaged in coaching relationships, this coaching looked
different in different places.
- **Depth, intensity, and/or quality of a teachers’ engagement.** Variations in level of
engagement led to experiences that were qualitatively different for individual
participants.
- **Program churn.** The responsive nature of the programs resulted in periodic
change in professional development offerings.
- **Interactions.** There are various interactions among variables such as teacher
knowledge, and also among combinations of learning opportunities.

Given these complexities, we propose in this report a model for teacher learning in
professional development. This model includes teacher characteristics, program
characteristics, school and student characteristics and student outcomes. Thus our
investigation of ECRW and SVMI has allowed us to elaborate on existing theories of
professional development and teacher learning.
The Complexity of Conducting Research on Teacher Learning

In this section of the report, we discuss ways that future studies might improve on the methods we employed in this study. In our view, future studies of teacher learning and professional development should:

- Articulate a conceptually clear, measurable set of variables
- Make a heavier investment in the development of reliable instruments for measuring teacher knowledge and skill
- Develop a reliable indicator of teacher implementation of the program’s ideas and/or of teachers’ instruction
- Develop reliable measures of teachers’ engagement, that is, the breadth and depth of their participation in a professional development program
- Use methods that allow for a multivariate analysis that do not presume hierarchical relationships among variables
- Separate the research from the Noyce Foundation staff more clearly

One final recommendation would be to reconsider the appropriateness of using individual teachers as the unit of analysis for research on professional development. Because of all of the variability and complexity in teachers’ experiences, knowledge, and practice, it is difficult to come to clear conclusions about the effects of professional development initiatives on their individual learning. And, keeping the end goal in sight, the true effectiveness of professional development programs will be found in the effects on student learning.

Steady Work: Implications for the Practice of Professional Development

In this final section of the report, we offer some closing observations that hold implications for the practice of professional development. One observation is that teachers are not always effective in identifying gaps in their own knowledge and deciding what they need to learn. Professional development programs would do well to help teachers become critical consumers of learning resources. Another observation is that, although disciplinary engagement can lead to increased content knowledge, it does not always do so. It may even contribute to other types of learning, and it remains a useful tool for professional development programs. Third, the fact that teachers’ perceptions of the usefulness of certain learning opportunities did not align neatly with the regression results calls into question the accuracy of self-reports for evaluating the utility of professional development events. We would encourage the development of alternate measures for assessing teacher learning. And finally, as professional developers pursue their own goal of continuous program improvement, we note the importance of holding all assumptions about educational goals and pedagogical truths open for critical examination and reconsideration.
Part 1:  
Introduction

It is now apparent that most of our efforts at school reform will come to nothing unless teachers are up to the task. Standards-based reform may be the lever that sets in motion the improvements the United States has sought in schools for decades. But common sense, parental experience, and the research literature are clear: The most successful school innovations rest on the time, talent, and skill of teachers. These are the people who make everything else possible, including all the other professions. Teachers count.  (The College Board, 2006, p. 9)

There seems little disagreement among policymakers, researchers, educators, administrators, or reformers that teachers are the critical component in improving U.S. education. Further, there is apparently universal agreement that high quality, on-going professional development for teachers is equally necessary:

The nation can adopt rigorous standards, set forth a visionary scenario, compile the best research about how students learn, change textbooks and assessment, promote teaching strategies that have been successful with a wide range of students, and change all the other elements involved in systemic reform – but without professional development, school reform and improved achievement for all students will not happen.  (American Federation of Teachers, 2002, p. 22)

But traditional “in-service” will not do, for in the last 15-20 years, there have been countless calls for the improvement of such professional development. Even more recently, there has also been call to collect data on the effectiveness of those programs. The research report here grew out of the Noyce Foundation’s interest in and commitment to those calls. Based on its own long term, and significant, investment in professional development, the Foundation also funded an independent research project to investigate a single not-so-simple question: “Does the Noyce Foundation’s investment in professional development make a difference? If so, in what ways?” In particular, this inquiry investigated the effects of two professional development projects on what teachers learned; because the Foundation itself collects data on student learning, we were also able to capitalize on that information as well.

We organize this report into nine sections. We begin with a brief review of the literature on professional development, before then sketching – in broad-brush strokes - a description of the Noyce Foundation, as well as the two professional development programs that served as the foci of this research. These descriptions are organized around a set of interrelated opportunities to learn that each program offers its participants, as well as theory of action that drives the Foundation’s school-based work. We then describe patterns in the interview and survey data concerning teachers’ learning. To make those claims “come alive,” we offer several cases of teaching practice. This part of the report serves as its empirical “heart.”

The cases make one thing clear: There is considerable appreciation for and good will toward SVMI, ECRW, and the Noyce Foundation’s investment in teacher learning. Most participants report learning something important from the professional development programs. For some, their confidence as writers or mathematicians, or as teachers of writing or mathematics increases. For others, they adopt and use new instructional materials or methods. But as other research has demonstrated (e.g., Ball, 1990b; Borko, 2004; D. K. Cohen, 1990; Franke, Carpenter, Fennema, Ansell, & Behrend, 1998; Heaton, 1992; Kennedy, 1999; Knapp & Peterson, 1995; Wilson, 1990), the effects of the professional development or other efforts designed to reform teachers’ practice are shaped by myriad factors. Thus, when the ideas of ECRW and SVMI enter schools and classrooms, they take many forms, for what teachers learn in professional development programs is not the sole determining factor for what they teach. As we
watched these programs “go to school,” we also identified several common factors that appear critical to how and when the professional development programs make a difference. These analyses are more speculative, since they arose from the data analysis and were not part of the research design (and, therefore, cannot be rigorously tested in the data collected). We conclude the report with a summary of the empirical, conceptual, and methodological lessons that we have learned from this project, along with some modest recommendations for professional development leaders and funders, as well as policy makers.
Part 2:  

Review of the Literature

In light of current educational reforms that endorse and promote high-stakes assessment and accountability, teachers are under growing pressure to change and improve their practice (D. K. Cohen & Ball, 1990; Sykes, 1996). With the intense focus on raising student achievement, teacher quality is seen as critical. For student achievement to improve, classroom instruction must improve, and thus the responsibility for change falls squarely on the shoulders of teachers. It has also become increasingly clear that the requisite changes are substantial in nature (D. K. Cohen & Ball, 1990). Instead of simply adopting a new technique here or implementing a new program there, teachers are being asked to make deep changes in their instructional practice. To meet the ambitious content standards of current educational reforms, teachers must examine — and often transform — their core beliefs, knowledge, and habits (Gallucci, 2003; Stein, Smith, & Silver, 1999).

For teachers to make these substantial changes in their practice, they must have access to sufficient opportunities to learn, which are more often than not encountered in professional development programs. Indeed, in the 1999-2000 administration of the Schools and Staffing Survey (SASS), 99% of teachers reported that they had participated in some form of professional development in the last 12 months (Choy, Chen, & Bugarin, 2006). Traditionally, professional development has involved the use of outside experts to transmit knowledge or information to teachers. The professional development opportunities associated with this traditional model frequently occur during single, one-time sessions and take place outside of classroom or even school contexts. Familiar modes of this traditional paradigm include in-service presentations, one-day workshops, and guest speakers.

This traditional professional development model has come under considerable criticism in recent years. One common critique is that although individual professional development sessions may each contain valuable information, they rarely work together to present coherent learning experiences that are intellectually challenging, connected to deep curricular issues, and cumulative (Ball & D. K. Cohen, 1999; Elmore & Burney, 1999; Little, 1993; Wilson & Berne, 1999). In other words, they occur as a series of fragmented, decontextualized experiences. Other criticisms include charges that traditional professional development opportunities lack follow-up support, disregard local contexts, offer procedural rather than conceptual knowledge, and are too far removed from actual classroom practice (Elmore & Burney, 1999; Hawley & Valli, 1999; Stein, Smith, & Silver, 1999; Stigler & Hiebert, 1999). The point about classroom practice is worth emphasizing: As Ball and Cohen (1999) argue, teachers have the opportunity to learn more in practice than anywhere else. After all, they spend most of their professional time working with students, and having experiences that are relevant to their learning and development. But they are also most often alone during those experiences, and professional development opportunities are seen as something that takes part apart from their practice, which means that we may be missing an enormous opportunity to leverage teacher learning in and from their daily work. A final criticism is that professional development often leaves classroom teachers with the burden of connecting the new information to their practice, making it fit their particular classroom situation. Thus teachers tend to enact changes in their practice as isolated individuals; if they encounter difficulties in implementation, the new ideas end up as a set of dusty binders stacked in a classroom corner.

Although much is still unknown about exactly what teachers learn and how they learn it (Borko, 2004; Kennedy, 1999; Wilson & Berne, 1999), there is a growing consensus that many of the learning opportunities offered to teachers have been inadequate at best. In response to the widely proclaimed deficiencies of traditional...
professional development, researchers have undertaken the task of identifying characteristics of effective programs (e.g., Kennedy, 1999). Out of this research have come numerous sets of core principles of effective professional development. Stigler and Hiebert (1999) suggest six principles for gradual, measurable improvement; Hawley and Valli (1999) offer eight; Stein, Smith, and Silver (1999) outline a new five-point paradigm; and Elmore (2002) offers what he calls the “consensus view.” Although each framework is slightly different, they tend to share common features. Where traditional professional development offered disconnected in-service training sessions, professional development reform calls for integration, contextualization, and inquiry, all grounded in the actual work of teaching. Wood and Lieberman (2000) illustrate this paradigm nicely:

Experienced teachers are more likely to grow and learn if involved in professional development contexts that build on their commitment to children, focus on the specific classroom dilemmas they face daily, and recognize teachers have learned from classroom experiences (Darling-Hammond and Sykes, 1999, Lieberman and Miller, 1999). More than instruction in generic teaching skills, experienced teachers need opportunities to develop capacities for reflection, collaboration, research, critique, and assessment. Perhaps most important, public education might truly improve if teachers could: develop and exercise their professional voices; make their knowledge and experience public; have that knowledge critiqued, refined and expanded; and exert constructive influence over the learning of children in classrooms beyond their own (Goodlad, 1984). (pp. 256-257)

Weiss and Pasley (2006) note some additional characteristics:

According to this consensus view, high-quality PD programs are grounded in research and clinical knowledge of teaching and learning. They are aligned with a school’s curriculum and assessments and focused on student learning in that setting. They facilitate teachers’ collaboration both within and across schools, they use existing teacher expertise to plan activities and cultivate leaders, and they include mechanisms for garnering principal support. High-quality PD programs both model and explicitly discuss methods of good practice (such as inquiry-based methods in science) and provide teachers with active learning opportunities. These programs aim to build teachers’ content knowledge and pedagogical skills. Finally, they are intensive, sustained over time to allow for integration of new knowledge into practice, and include follow-up support. (pp. 1-2)

In response to this emerging consensus, professional developers are transforming their work, and teachers are increasingly exposed to a range of novel learning opportunities, such as lesson study, coaching, and teacher inquiry groups. The hallmarks of this reform paradigm of professional development are that it draws on teacher experience and expertise, frequently takes place inside classrooms, involves teachers as active participants, and occurs over a longer period of time. The intended advantages are that teachers’ experiences are integrated and connected, their change efforts are supported by outside collaborators, and the work of improving teaching is communal, involving collaborative groups of learners and colleagues (Bryk, & Driscoll, 1988; Little, 1993, 2002; Westheimer, 1998; Westheimer & Kahne, 1993). Still, research that demonstrates that these characteristics lead to increased teacher or student learning is still needed (Borko, 2004; Garet et al., 2001; Hill, 2004; Wilson & Berne, 1999). However, there is a slowly accumulating body of empirical research exploring the effects of professional development (e.g., Desimone, Porter, Garet, Yoon, & Birman, 2002; Desimone, Porter, Birman, Garet, & Yoon, 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001; Grossman, Wineburg, & Woolworth, 2001).

It is within the context of this accumulated wisdom that the Noyce Foundation supported the development of two professional development programs — the Silicon Valley Mathematics Initiative and Every Child a Reader and Writer – to which we now turn.
Part 3:
The Noyce Foundation Investment in Professional Development: The Silicon Valley Mathematics Initiative and Every Child a Reader and Writer

Optimism is an essential ingredient for innovation. How else can the individual welcome change over security, adventure over staying in safe places? A significant innovation has effects that reach much further than can be imagined at the time, and creates its own uses. It will not be held back by those who lack the imagination to exploit its use, but will be swept along by the creative members of our society for the good of all. Innovation cannot be mandated any more than a baseball coach can demand that the next batter hit a home run. He can, however, assemble a good team, encourage his players, and play the odds. -- Robert N. Noyce

As part of its work in the San Francisco Bay area, the Noyce Foundation sponsors and runs two professional development programs: Every Child a Reader and Writer and the Silicon Valley Mathematics Initiative. Both programs aim to combine standards, assessments, professional development, and “data-based” practices in programs to improve student achievement:

The comprehensive approach of the Noyce Foundation programs might best be characterized as a set of “commitments,” a word used frequently by the Foundation:

- The use of standards to inform instruction;
- The use of performance assessments aligned closely with those standards;
- The analysis of data generated by those assessments;
- Professional development which is tied to the data analysis; and
- Networks of professionals who will carry out the work need [on-going and consistent] support. (Gerstein, n.d.)

Let us consider the content and character of each program.

**Every Child a Reader and Writer (ECRW)**

Every Child a Reader and Writer (ECRW) began as a formal program sponsored by the Noyce Foundation in the fall of 2000. Up until then, the Foundation had sponsored literacy activities throughout the Bay area, but Ann Bowers, chair of the Board and founding trustee of the Foundation, was interested in developing a systematic program in reading and writing. In her travels, she met Sally Hampton, a language arts specialist who had worked with Lauren Resnick, Marc Tucker, and others on the New Standards Project, an effort housed in the National Center for Education and the Economy (NCEE). Sally moved to Palo Alto and helped to design ECRW. Five schools in five “core” school districts were selected, and the Noyce Foundation helped to support a literacy coach for each school (the district was also asked to make an in-kind contribution as a demonstration of its commitment to the effort). Coaches would be trained by Hampton and other Noyce staff and consultants. Each coach would work with one “go-deep” teacher at the school, putting the curriculum materials and teaching practices into place that were seen as constitutive of ECRW. The goal was to build the capacity of the teachers and coaches, then to use that resource to build the capacity of the school, and then to use the capacity of that school to spread the reform throughout the school’s district. Go deep teachers did not have to be good teachers of writing, but they did have to make a commitment to put ECRW into practice, quickly.

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5 See [www.noycefdn.org](http://www.noycefdn.org).
6 See [www.ncee.org](http://www.ncee.org).
At the same time, the Foundation selected “exemplary” teachers – one at each grade level across all five school districts – whose classrooms could serve as sites for observing good practice.

The Foundation’s commitment to those districts was considerable: it took responsibility for educating the coaches and the go deep teachers, which involved summer institutes, exemplary teacher visits, and Saturday workshops, as well as locating, developing, and disseminating relevant instructional and professional development materials. In the meantime, the Foundation also established relationships with “partner districts” that applied to participate in a limited range of Noyce-sponsored activities including a series about “the principal as instructional leader” and “teacher leadership training.” The program conceptualizes schools as belonging to “cohorts,” and each year, a new cohort of schools is added to the effort. Expectations are, understandably, higher for cohort schools that have been with the effort longer.

At the end of the first year, the Foundation also hired Audrey Poppers, who had been an associate superintendent in one of the original five districts selected to participate. About a year and half into the effort, Audrey replaced Sally as the director of ECRW. In 2002, a sixth core district was added to the effort, and one of the original districts was dropped for lack of sufficient commitment.

As participants in Every Child a Reader and Writer (ECRW), teachers learn to teach writing using writer’s workshops. It is presumed that to do so, teachers need to understand the ways in which content knowledge, performance standards, and student performance inform instructional decision-making. Teachers in schools that are new to the initiative participate in a summer institute, followed by five additional days throughout the school year during which they engage in a study of another teacher’s writer’s workshop. There are also Exceptional Speaker series (also known as the Saturday Speakers series), work with coaches, and visits to demonstration classrooms available to participating teachers throughout the year. While teachers implement the workshop in their own classrooms, they are simultaneously reading professional literature, reading more widely in children’s literature, learning to use that literature to model a variety of writing “craft moves” for students, engaging in writing within a chosen genre study themselves, and conducting a case study of a student in the classroom where they are observing exemplary practice. Some teachers also participate in book groups in their own schools.

A typical teacher participating in ECRW attends a summer institute in which she learned about the “nuts and bolts” of ECRW. During that institute, she would work with consultants and staff, she would write, and she would learn about the teaching of writing. She would then return to her school and be expected to set up her classroom for writers’ workshop. This would include posting handmade posters about writing conventions and strategies, identifying “touchstone” books that she and her students would refer to collectively throughout the year, and getting ready to teach her students both about various genres and about the “writerly life.” Throughout the year, she would work with a coach, who would come to her classroom, watch her teach, find relevant resources for her, conference with her about her students’ writing, and sometimes model a lesson. She might also observe other teachers in her own school, or

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7 One challenge of studying these programs is that they were regularly changing, both due to shifting budget constraints and to program improvements. So, for example, the model for conducting the “induction” changed between year 1 (2001-2002) and year 2 (2002-2003) of data collection. In the first two years of the initiative -- we started collecting data in year 2 -- the induction was five days in the summer, followed by exemplary teacher visits during the year. The induction institute was eventually pared down to three days in the summer, followed by five days of classroom visits and seminars during the school year. We discuss the implications of this churning for our research later in the report.

Teacher Learning from Professional Development

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visit exemplary teachers at other schools. If she was so inclined, she might also attend the Exceptional Speakers Series on Saturdays throughout the year. Some experienced ECRW teachers also participate during subsequent summers in an Advanced Institute during which they not only score student portfolios, but use what they are observing in student performances to think about instructional "next steps."8

ECRW coaches participate in their own professional development. There is a fall retreat and regular meetings throughout the school year during which they deepen their own content knowledge; read professional literature related to adult learners, content-focused coaching, and writing instruction; develop site plans in collaboration with their principals; collaboratively plan exemplary site visits; and visit other school sites to observe and critique one another’s coaching practices.

A teacher who is an active participant in ECRW understands many things about writing. She understands that there are different purposes to writing: to amuse and to describe, to direct and to gather information, to compare or observe, to clarify thinking or to hypothesize, persuade, advise, inform, explore. For these purposes, there are different forms of writing: stories and poems, scripts, personal letters and science reports, advertisements and letters to the editor, recipes and stage directions, portraits and poems, journals, diaries, histories. She would understand that good writing has purpose, focus, clarity, structure, and organization; that the writer would have made a decision about the appropriate genre and would have exercised the “craft” of writing,9 including the artful use of language. Good writing is full of voice, and attends to conventions of grammar, spelling, and punctuation. The ECRW teacher would also see reading and writing as intimately intertwined: one reads good literature to build community, to explore genre, to encounter authors who might inspire. One also reads literature from a “writerly” perspective – finding ideas for writing, studying structure, searching for the author’s meaning, examining “craft” moves. Teachers of writing have a lot to do: they must help students generate ideas for their own writing and guide the selection of a good one among the many generated; they need to help students develop trains of thought about an idea, begin developing a focus, locate the importance of a topic. They also need to help students learn to select an appropriate genre to fit their purpose and audience, write a draft, organize their writing, re-read it, share, revise, edit. An ECRW teacher confers with students, provides mini-lessons, reads, writes. She is also a keen observer of her students and their writing, for she must be able to hear her students in order to help them take the next step in their writing.

A teacher who has mastered this particular vision of the teaching of writing would have learned to teach in “the Noyce way” (as many teachers referred to what they saw as a clearly articulated view of good teaching). If you walked into her classroom, you would see students working independently, surrounded by books, reading and writing, bursting with ideas. When writing, there would be a low level of noise and all of the talk would be about writing. Teachers would have internalized ECRW and would believe it, there would be charts on the wall (the language of these charts is literally the language used by children and teacher in class), student work would be in evidence, and it might be hard to locate the teacher. She’d most likely be hunched over a piece of student writing, conferencing and speaking softly, not unlike her students who would be partnering with their peers. There would be established rituals and routines: mini-lessons, conferring between teachers and students, response groups and pairs with students getting responses to their draft writing from the teacher and their peers, and author’s chair. The tone of the classroom would be respectful and serious, questions authentic, students would be engaged in writing about things they care about, and teachers would be encouraging students to write to new levels. And as we have already

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8 Approximately 10.8 percent of teachers participating in ECRW attended the 2003 Advanced Institute (131 teachers out of 1216); in 2004, the percentage was slightly higher: 331/2287 or 14.5%.

9 We use quotation marks to note when we are using the language of the program.
noted, writing and reading would be seamlessly intertwined: children would do readers’
workshop for an hour, and writers’ workshop for another hour; work on skills would be
consistent, targeted, on-going, and embedded in the context of real writing.

A reasonable question to ask is: What evidence is there that this is a program that
we might learn something from? One answer to the question is that the program has
many of the characteristics that scholars suggest “matter” when it comes to professional
development, and so the program offers a test case for gathering more empirical
evidence about those characteristics. Another way to answer that is to consider the
impact of ECRW – both in terms of scope and scale, and in terms of student learning.
The program’s reach is considerable. By 2005, thirty-four schools participated
intensively in the reform, and another 40 schools less intensively; over 13,000 students
were taught by teachers with some involvement in ECRW. As part of their on-going
efforts to assess the effects of ECRW, the Foundation staff has collected student-
learning data on program-developed assessments and on state-mandated standardized
tests. Student-created portfolios with narrative, informational, response to literature,
procedural, on-demand, and conventions entries are collected and scored in the late
spring. Results are disaggregated by school, district, grade level, socioeconomic status
and the like; they are also compared with state level tests in language proficiency and,
when available, writing.

And those data suggest that the program is effective, in particular, when
implemented appropriately and when effects are tracked over time. In 2002, students in
ECRW schools showed significant gains in narrative and informational writing growth
scores in grades K-6; in addition, data demonstrated that English language learners
were making gains in ECRW classrooms, although students whose first language was
English were benefiting more (Educational Data Systems (EDS), 2003). These results
held in 2003-2005, although in 2005, evaluators found an inverse relationship between
the percentage of students at or above standard in their portfolios and grade level.
They hypothesized that this was due to the increasing difficulty of standards for writing
at the upper grades (4 and 5).

But what of student scores on assessments that are independent of the effort itself?
When students’ scores on the state assessment in language proficiency scores were
compared, there were no significant differences between ECRW students and non-
ECRW students in 2002, 2003, or 2004. Of particular note is that the state instituted a
writing test in 4th grade in 2004. Overall, ECRW students’ scores did not differ
significantly from those of non-ECRW students. However, students who had been in
the initiative for 2 or more years had significantly higher STAR scores. Moreover,
students who were in the initiative for 2 or more years and who were in classrooms of
high implementing teachers had significantly higher STAR scores than their peers
(EDS, 2004).10

In 2005, researchers found that students who had teachers who were rated as high
implementers had higher portfolio and STAR scores, as did students who were in the
program for 3 or more years. English learners continued to do less well than English
speakers, but both groups showed demonstrable gains in their writing ability over the
course of the year (EDS, 2005).

In sum, the scale of the project is impressive, offering content-rich induction to
large numbers of teachers. Student learning data are equivocal. Certainly the program
appears to be doing no harm, for students with ECRW teachers do not show lower state
test scores than do students who are not taught by teachers in ECRW schools. Using a
more suitable measure of achievement (the portfolio), ECRW has found that students

10 Aware that teachers were at different stages of implementation, the ECRW staff
developed a scale by which to locate each teacher’s implementation status. We discuss
this scale later in the report.
who are in the initiative for a number of years and whose teachers demonstrate a higher level of implementation perform better on both state level assessments and the ECRW-specific assessments. We return to the problems associated with collecting relevant student data at the conclusion of this part of the report.

We now turn our attention to a mathematics professional development program from K-12 teachers that served as the second case for this research.

The Silicon Valley Mathematics Initiative (SVMI)

Positive change in education occurs through a continuous loop of focusing on high standards, assessing students’ work to the standards, examining students’ products and analyzing students’ understandings from the assessments, developing effective educational strategies and practices that are consistent with the findings, and tailoring instruction to enhance student learning and understanding... Improved achievement is an outcome of improved instruction. Improved instruction is an outcome of ongoing, comprehensive, intensive professional development. (SVMI, 1999)

Started in 1996, the Silicon Valley Mathematics Initiative (SVMI) has grown in to a sprawling set of opportunities for teachers, administrators, and districts to learn about mathematics teaching and learning. Its stretch is wide: in 2005, over 14,600 students in the Bay Area had teachers who participated in SVMI programs; 55 Bay Area schools were part of the initiative. SVMI includes several components, including the Mathematics Professional Development Network, the Mathematics Assessment Collaborative (MAC), and the Summer Institute and the Summer Lab School, a collaboration with the Santa Clara Valley Math Project. We describe each component briefly.

The Mathematics Professional Development Network allows teachers to work with coaches in their classrooms as well as to meet with other teachers and teacher leaders from across the Bay area in regular regional meetings. Through the MPDN, coaches work with a handful of teachers in a home district – evaluating student work on assessments, co-teaching, modeling lessons, observing and reflecting on teachers’ instruction. During the year, all of the teachers who work with a particular coach are also invited to regional professional development meetings where they read research, do mathematics problems, hear mathematics education experts, participate in lesson study, review new curriculum, and the like.

The Mathematics Assessment Collaborative (MAC), directed by Linda Fisher, was established by the Noyce Foundation in 1998 for the purposes of assessing student performance on challenging mathematical tasks in response to the growing concerns for accountability in standards-based reform efforts. Formative and performance assessments are a strong focus of all of the work of SVMI – the “cornerstone” as program information describes it -- but the work associated with MAC is driven by assessment concerns. There were 34 member districts in 2005, and throughout the year teachers use assessments with their students, gauge students’ development over time, and use the assessment data to refine instruction. The assessments are meant to be mathematically rich, instructionally powerful counterexamples of accountability to the more prevalent standardized, multiple-choice tests. A typical problem might look something like this:

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11 The program’s early growth was extraordinary. In 1996-97, 812 students of 42 teachers in two participating districts participated in the assessments through MAC in 1997-98, that number jumped to 6200 students in ten districts with 308 participating, and had been climbing ever since.
Alexander makes six quarts of brown paint by mixing equal quantities of yellow paint and violet paint. The violet paint is made from one-third red paint and two-thirds blue paint.

1. How much red paint does he use?
2. How much blue paint does he use?
3. What percentage of the brown paint is made from blue paint? Explain how you figured it out.

MAC contracts with CTB-McGraw Hill and the Mathematics Assessment Resource Center (MARS) to create performance assessments that are used for a summative, annual evaluation of student learning across all of the participating districts. The purpose is straightforward: to create well-designed, high stakes, mathematically challenging assessments that can be used to evaluate student learning and to drive instruction. Teachers administer the tests to their students district-wide: in 2005, nine different exams were administered (grades 2- course 2 (geometry)); 32 districts reported data; 65,319 examinations were administered, hand-scored, and reported; and over 2000 teachers administered the exams, with nearly 1100 teachers spending six or more hours scoring the exams. The assessments are scored by teachers and coaches, and the scoring sessions are conceptualized as an opportunity for professional development for coaches, teachers, and principals. Fisher, the MAC director, works with a small set of teacher leaders to identify the common errors that students make across all of the examinations. That information is used to create Tools for Teachers (also referred to as a “toolkit”), a compendium of test results used to design continued professional development.

12 The MARS assessments were originally developed in an NSF-funded project that involved a collaboration between the University of California-Berkeley (Alan Schoenfeld), Michigan State University (Sandra Wilcox), and the Shell Centre in Nottingham, England (Hugh Burkhardt). The assessments are now commercially available through CTB-McGraw Hill. SVMI is the single largest user of the assessments.

A brief explanation of the role of SVMI/MAC in the development of these items might be in order:

The tasks and the scoring rubrics are designed by a MARS team, led by Rita Crust. The initial drafts are sent in April to the members of the Mathematics Board, who respond with comments and suggestions on tasks and the test as a whole; two MAC/SVMI leaders attend the Mathematics Board, one as co-chair. This leads to the revision of some tasks prior to the first classroom trials in May/June, which are organized by the MARS Michigan State group. In the light of data from the first trials, MARS refines the tasks and scoring rubrics for the second trials in October/November. Their main purpose is to provide the 15 exemplar student responses to each task that underpin the scoring training, though further minor revisions of tasks and rubrics are sometimes needed.

This complete set of materials is then worked through by members of the MARS and MAC teams in the pilot scoring training workshop in January; its purpose is to clarify the scoring guidance and agree its application to the exemplar student papers. This provides MAC, and others who may attend, with a firm basis for the training of scoring leaders in the various MAC districts. MAC scoring in March/April provides data and student papers for the meeting of the Mathematics Board in April/May at which the cut-scores are determined and the following years tests considered, completing the cycle.

The roles of MAC in this process reflect the initial co-development of Balanced Assessment in Mathematics in the late 1990s, sustained by its continuing as the largest client. They provide essential elements in the test development, complementing the feedback from classroom trials and the expertise of the Mathematics Board. (Linda Fisher, personal communication)
The third leg of SVMI involves the Summer Institute and Summer Lab School, which have been co-sponsored by the Noyce Foundation and the Santa Clara Valley Mathematics Project (SCVMP), one of the subject matter projects in California (American Institutes for Research (AIR), 2002; St. John, Ramage, Stokes, Caskey, Hirabayashi, Houghton, & Huntwork, 1998; Stokes, Caskey, Heenan, Hirabayashi, Medina, Ranage, & St. John, 1998; Wilson, 2003). The summer institutes immerse teachers in doing mathematics, as well as analyzing and creating curriculum, assessments, and learning about alternative instructional strategies. The summer lab schools allowed teachers to pair with another teacher and work with students enrolled in summer school.

Even though an individual teacher might not participate in all of these varied opportunities to learn, the SVMI staff work hard to impose a coherence and alignment on this carnival of activities. They do so primarily through two means. First, they identify a set of “core ideas,” or what they consider to be the five most important concepts at every grade level. For instance, one core idea is “patterns, functions, and algebra”:

Core Idea 3: Patterns, Functions, and Algebra: Understand patterns and use mathematical models to represent and to understand qualitative and quantitative relationships.

Grade 3:
- Describe and extend numeric patterns;
- Represent and analyze patterns using words and/or tables;
- Illustrate general principles and properties of operations, such as commutativity, using specific numbers;
- Use concrete pictorial and verbal representations to develop an understanding of invented and conventional symbolic notations;
- Model problem situations with objects and use representations such as graphs and tables to draw conclusions . . . .

Grade 4:
- Represent and analyze patterns using words, tables, and graphs;
- Find the results of a rule for a specific value;
- Use inverse operations to solve multi-step problems;
- Use concrete, pictorial, and verbal representations to solve problems involving unknowns;
- Understand and use the concept of equality

Second, the staff use a “cycle of formative assessment” to drive their work with all SVMI participants:

13 This association allowed SVMI to leverage some of the financial resources that the subject matter projects had for the joint ends of the Noyce Foundation and the SCVMP. However, shifting investments in professional development at both the state and Foundation level has led to some changes in how the summer programs are conceptualized and organized, not unlike the shifts we witnessed in ECRW’s summer institute.

14 Indeed, program participants see the various components as coherently related to one another. In 2003 and 2004, seventy-three and seventy-four percent (respectively) of survey respondents agreed or strongly agreed with the statement “components were coherently related to one another” (Wilson & Mapuranga, 2006).

15 The core ideas were not generated de novo; rather, they are informed by an analysis of the leading curricular documents and other forms of policy guidance from relevant professional associations like the *Principles and Standards for School Mathematics* (NCTM, 2000) and *Adding it Up* (NRC, 2001), which are quoted liberally in presentations by staff associated with the program.
Like ECRW, this program design is intended to address the fact that teachers’ opportunities to learn are often fragmented, a patchwork of many different kinds of professional learning (Ball & Cohen, 1999; Wilson & Berne, 1999). Rather than treating this patchwork as a problem to be remedied, SVMI staff presume that a hybrid set of professional development experiences may be functional if they are aligned with a core set of mathematical and pedagogical ideas and commitments. The program’s assumption is that good professional development is somewhat flexible and varied, tapping into the various locales where learning is possible, but that it consistently and insistently spirals around a core of both mathematics content and organizational/philosophical/pedagogical commitments. Ideally, a teacher participates in most of these locales, but due to the complex distribution of funding, only some teachers are able to participate in all of these experiences, while most participate in only some parts of the program.

Formative assessment is a key feature of all the components of the professional development program. Most of the districts involved with SVMI also use the MARS assessments. In addition, some participants are members of lesson study groups (cf., Lewis & Tsuchida, 1998). The program is informed by what staff consider to be the “cutting edge” ideas in education and mathematics education reform: the work of Deborah Ball (1990a, 2000) and Jo Boaler (2002), Lucy West (West & Staub, 2003) and Catherine Lewis (Lewis, Perry, & Murata, 2006; Lewis, & Tsuchida, 1998); ideas about cognitive coaching and lesson study, performance assessments and Singapore models. Districts participate by funding coaches and using assessments to document student performance. Depending on funding and commitment, districts and schools vary in how complete and unified participation in the program is. For example, in some schools a solitary teacher may participate in SVMI, while in other schools the entire department participates and incorporates SVMI into their school-wide positions on mathematical learning. In one district, entire schools participate in lesson study groups.

A teacher who participates fully in SVMI attends one or more weeklong summer workshops. These consist of intensive all-day sessions, each of which focuses on a specific content area, such as geometry or algebraic thinking, and offers pedagogical

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16 Amy Gerstein, then-Executive director of the Noyce Foundation, had been associated with the Coalition of Essential Schools previously. Thus, the resonance between the Coalition’s “cycle of inquiry” and this cycle of formative assessment is no coincidence.
strategies for supporting mathematics discussions around each content area. During these sessions, teachers participate in discussions about mathematics pedagogy, listen to presentations by leading experts, and engage in mathematics problems with fellow teachers. The fully participating teacher also has a coach, an experienced mentor who works with him or her throughout the school year to plan lessons, observe classes, and provide reflective feedback. Together, the coach and the teacher attend monthly all-day professional development sessions throughout the school year where all of the teachers (who are working with individual mentors) network with one another. Like the summer sessions, these events combine learning of pedagogical strategies with opportunities for the teachers to “do” mathematics. Participants also use “Problems of the Month,” problems that are designed and/or distributed by SVMI staff and intended to promote the teaching of nonroutien problems schoolwide.

Like ECRW, SVMI is based on a set of normative assumptions about “good” mathematics teaching and learning. Good teachers encourage students to talk, and encourage them to feel safe in classrooms. Mistakes are not bad, but good. As one coach said: “I tend to help teachers use student errors or misconceptions in a way that does not make the kids feel like they have done something wrong.” In the Mathematics Teaching Rubric, developed by the staff to help coaches estimate the quality of teaching they observe, exemplary teachers (4 on a 4-point scale) "orchestrate discourse . . . pose questions . . . insure students' ownership and understanding . . . understand that assessment of students, analysis of instruction and learning experiences are fundamentally intertwined . . . uses a large variety of assessment measures." “Limited teaching” (1 on a 4-point scale) involves a teacher who "directs the class . . . may listen to some student responses . . . follows the textbook . . . follows the curricula math goals of the lesson . . . instructional decisions may be aligned with state standards . . . is diligent about following the timeline of instruction based on a set of standards . . . uses mostly direct instruction for efficiency . . . bases his/her evaluation mostly by written products, which are usually tests and quizzes." In contrast, a “good” teacher — in the Noyce “way” — uses models to help students develop their mathematical thinking, asks a lot of questions, and opens up the discourse in the classroom to students; she “always promotes classroom discourse in which students have ownership and responsibility” (emphasis added). As one coach described what she paid attention to during classroom visits:

A lot of times when I am observing, I will write down the exact question that the teacher asked and in my notes, I usually make notes about certain things that I would like to talk to her about in the post conference. “I am wondering why you asked it this way” . . . I might even give her some suggestions to get her thinking about and reflecting on the kinds of questions that she is asking and where those tend to lead the students. My goal is to have teachers be very aware of [the kinds of questions they are asking] . . . to make that a natural part of their teaching. There is an area between a really closed question and a really open-ended question, where you want kids to think about something and to explain their thinking, to share their thinking with each other.

And what evidence exists that this program would be one that we might learn from? For one, it too shares hallmark features of the “model” professional development visions bandied about in the literature on student learning. And like ECRW, SVMI has been vigilant about collecting student data over time, and they have seen steady increases in students “meeting the standard” on the MARS assessments from 2000-2005 (Noyce Foundation, 2005) (see Figure 3.2).

17 Similarly, Greenleaf and Schoenbach (2001) found that teachers who participated in the Strategic Literacy Initiative, a professional development program for secondary literacy teachers, "moved from seeing students' errors and confusion as evidence of their deficits to seeing these same errors and confusion as a map for instructional action" (p. 15).
SVMI staff also compare SVMI students’ achievement on the state standardized exam to students who do not have SVMI. Students in SVMI schools did as well or better than comparable students on the SAT-9 tests between 1999 and 2002. In 1999, 48% of California students achieved at or above the 50th percentile, 60% of SVMI students did. In 2000, about 56% percent of CA students did, over 56% of SVMI students did (Foster, 2001).

In addition, the staff have found that larger percentages of SVMI students met standards for the 2005 California Standards Test (CST) than did students from non-SVMI schools (Noyce Foundation, 2005). The exception here was 7th grade, where the percentages were the same for SVMI and non-SVMI students. Like ECRW, SVMI is interested in decreasing the difference between the scores of the high- and low-performing students: In 2003, students from all ethnic groups scored at the highest level on the MARS assessments, but only students of color performed at the lowest level and poor students were much more likely to achieve below standard (Noyce Foundation, 2004).

SVMI staff consistently argue that the MARS assessment is a legitimate alternative to the standard, mandatory assessments given to California students, such as the SAT-9 and the California Standards Test (CST). In fact, Foster (2005) argues that the MARS assessment “trumps” these assessments, that is, that high performance on the MARS assessment predicts high performance on the standard assessments, but high performance on the standard assessments does not reliably predict high performance on the MARS assessment. Using this result, he argues that the knowledge needed to perform well on the MARS assessment includes and supersedes the knowledge needed to perform well on the standard assessments.

Given the fact that, historically, most professional development programs do not collect such data, it is heartening to see some evidence, for both ECRW and SVMI, that student achievement increases when students work with participating teachers over time. Of course, several problems arise with the data that are used. First, as Foundation staff will point out, the state tests are not well aligned with the goals of either program, thus violating an important principle of test use, or as the American Educational Research Association (2002) argues: “Both the content of the test and the cognitive processes engaged in taking the test should adequately represent the curriculum.” Since the goals of SVMI and ECRW are much more ambitious than the knowledge and skill measured by the SAT-9 or CST, one would not necessarily expect to be able to assess the programs’ impact on student learning using those tests. This is one major reason why the programs need to use alternative assessments to track effects.

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18 The vertical bars represent different years of the test; some years are not present because the test was not administered.
However, this raises a second issue: The assessments used are potentially compromised by the influence of the program staff on their development. Although the MARS assessments are distributed nationally, the relationship between SVMI staff and that project is longstanding and complex, and it is not out of the question that SVMI has had an influence on the items and/or the scoring processes. In the case of ECRW, the “in-house” nature of the assessments is even more problematic, since the portfolio assessments are developed solely by the staff (although the staff are religious in soliciting outside advice and critique). There is an obvious Catch-22 here: Given the lack of high quality assessments for student learning, the Foundation programs have been obliged to either create or help create assessments that are better aligned with their efforts. Nonetheless, these assessments are open to questions of external validity.

Finally, one would also expect to see early improvements in students’ scores, followed by leveling off, as this is not an atypical response to the introduction of a new assessment (Linn, 2000): “Gains in the first few years following the introduction of a new testing requirement are generally much larger than those achievement after the program has been in place for several years” (p. 7), suggesting that we need to consider the trend data cautiously. We return to these issues in the report’s final section when we discuss implications for policymakers and researchers.

Core Beliefs of ECRW and SVMI

Both ECRW and SVMI are based on a similar set of core beliefs that guide their structures and processes. While those resonate with the principles and beliefs bandied about in national discussions of professional development, we take a moment here to explicate the Noyce-specific beliefs. First, there is the firm belief that writer’s workshop methods (for ECRW) and performance assessments (along with the use of a wide array of representational and instructional tools) (for SVMI) are effective ways to teach writing and mathematics to all students. Related to this belief are the underlying ideas that students should engage in authentic, purposeful writing and mathematics; instruction should be responsive to student interests and ideas; and writing/mathematics must be understood as processes (generating and revising text (ECRW) and problem setting and exploring (SVMI)) as well as products (various genres and various proofs and mathematical content).

Second, ECRW and SVMI embody a related belief that adopting writer’s workshop or performance assessment and new teaching methods to their fullest extent will require most participating teachers to make significant changes in their practice and in their understanding of teaching, learning, and writing/mathematics. Staff members (including program directors, assistant directors, and coaches) realize that implementation of these new pedagogies and curricula can range from full, deep implementation to partial, superficial adoption of ideas and techniques. They are committed to working toward a deeper level of change that is manifested not only in the presence of specific materials and classroom practices but also in subtler, observable changes in classroom discourse and teacher/student roles.

A third belief involves the conviction that substantial, deep changes in practice do not happen quickly. As the ECRW program literature explains, “It is not reasonable to expect comfortable and effective implementation immediately following initial professional development. The establishment of effective workshop practice should be regarded as developmental” (Poppers, 2004, p. 1). Thus, both programs are committed to a long-term, gradual process of change.

Fourth, ECRW and SVMI’s designs reveal a strong belief that teachers must be supported during their process of change. This support comes from a variety of sources and occurs in a variety of settings: classroom-based coaching, school-wide study groups, intradistrict visits with exemplar teachers, and off-site opportunities to
collaborate with other teachers/coaches, as well as learning from presentations from outside experts.

Fifth, the programs are grounded firmly in the belief that teachers, like students, learn best by doing. ECRW and SVMI teachers learn how to conduct writer’s workshop by participating in it, just as their students learn about writing by writing and reading. SVMI teachers do mathematics, and are asked to solve problems like those posed to their students; they also spend unusually intense periods of time discussing various student responses to assessments for the purposes both of scoring those assessments and understanding what their students understand or do not understand. ECRW and SVMI leaders believe that effective professional development entails teaching teachers as you would want them to teach their students, either through modeling or using the instructional techniques associated with writing and mathematics that the teacher-participants will eventually use in their own classrooms. Related to this is the belief in the value of “disciplinary engagement,” or the active participation of teachers in “doing” the subject matters: writing and solving mathematics problems, reviewing and critiquing others’ writing and critiquing various mathematical solutions (Duffy, Fiori, & Wilson, under review). Unlike some professional development programs that offer fragmented, how-to information across a wide range of topics, ECRW and SVMI maintain a tight focus on reading, writing, and writing instruction and on solving mathematics problems and using mathematics assessments, and emphasize deep craft knowledge in favor of superficial, procedural knowledge.

Both programs are also based on the belief that effective professional programs and reform initiatives must be both systematic and flexible. Program staff recognize the need for stability and structure, but also the need for responsiveness to local situations. A program that is too flexible would lose its internal consistency, while a program that is too rigid risks outright rejection by local actors. On a related note, the programs are also aware that teachers’ needs are not static, and that successful professional development must be responsive to teachers’ changing needs, just as effective teaching must be responsive to students’ changing needs.

Finally, both programs are based on the assumption that there must be on-going assessment of the professional development programs to provide data on how best to improve ECRW and SVMI. The data used range from student achievement on writing and mathematics tasks, teacher feedback during various professional development events, and internal evaluations. Of particular importance is the use of student achievement to drive the reform. In describing one theory of professional development that drives the programs, Gerstein (n.d.) reiterated the cycle used in SVMI:

First, students take a performance assessment exam, which generates data on student performance. Second, assessments are evaluated/scored by teachers and other members of the system. Third, the data on performance are analyzed and written up to describe and define the kinds of mistakes and strategies students employed in the assessment exercises. This analysis is used to focus professional development efforts for coaches and teachers. . . . The assessments are administered again and then analyzed for improvement in a cycle of data-based inquiry, which focuses the work.
Theory of action. During our research, the Foundation staff also regularly articulated the “theories of action” that drove their work, which were perhaps best seen as program-specific instances of the larger, overarching theory of action that drove the Foundation’s work more generally. One essential precept of the Foundation’s theory was the idea that belief follows practice (Guskey, 1986; McLaughlin, 1991). Participating teachers were asked to implement writer’s workshop methods in their classrooms regardless of whether or not the workshop approach is consistent with their deeper beliefs about teaching and learning. Similarly, teachers in SVMI all use the MARS assessments in district-wide efforts to collect data on student learning. The assumption is that teachers will eventually come to believe in each program as they see its positive effects on student learning in their classrooms. In this sense, using the program materials created the possibility that teachers’ classrooms would become richer environments for both student and teacher learning.

A second component to the Foundation’s theory of action is that the program itself must change. As mentioned above, both ECRW and SVMI were designed to be both systematic and flexible, presenting a stable and stabilizing structure but allowing, even encouraging, adaptations within a certain range of acceptable possibilities. Just as teachers are expected to adapt their teaching to meet their students’ diverse and changing needs, the ECRW and SVMI programs are also expected to change in response to the needs of participating teachers. Program staff maintain consistency and stability through planning for negotiated change in practice within a set of non-negotiable principles.

A third tenet of the Foundation’s theory of action is that the sustainability of reform depends on developing expertise and leadership capabilities in participating teachers. Within the programs, teachers have opportunities for professional advancement through assumption of leadership responsibilities. This opportunity for advancement within the profession is unusual for the teaching profession, which generally bestows status and privilege based on experience and seniority rather than any real differentiation of roles, responsibilities, or achievements. In ECRW and SVMI, some teachers are able to advance by becoming coaches. The coaches are typically former teachers, although some are still classroom teachers, fulfilling both their teaching and their coaching responsibilities on a part-time basis. Teachers can also advance by becoming exemplary teachers and opening their classrooms as models for others. These exemplary teachers gain a certain amount of prestige associated with their position, but they also gain the benefit of being seen as authorities and having their opinions and ideas taken as expert counsel. They are seen as knowledge producers, not simply knowledge users.

Teachers can also gain leadership experiences within their schools as they engage in teacher research or lesson study groups. In schools with a collaborative culture that fosters teacher leadership, some teachers are able to play an active role in partnering with school- and district-level administrators to make curricular and programmatic changes. The Noyce Foundation’s practice of devolving leadership responsibility benefits teachers by giving them a voice in decision-making as well as opportunities for professional advancement. At the same time, it benefits the program by creating a class

Throughout the time that we studied ECRW and SVMI, both programs and the Foundation produced memos and reports that explicated their “theories of action” and associated strategies. These shifted somewhat over time but here we have tried to highlight major features that were articulated for the duration of this research project. We failed to ask where the language came from, but our assumption is that the staff were influenced by talk of “a theory of action” that was launched by the classic work of Parsons and Shils (1951), and became popular in education as the work of Argyris and Schon (1974, 1996) was picked up by educational reformers in the age of standards-based reform (e.g., Hightower, Knapp, Marsh, & McLaughlin, 2002). A google.com search for “school reform” and “theory of action” results in over 15 million hits.
of educated, motivated professionals who are willing to play active roles in school-based educational reform. This is very much in line with Robert Noyce’s idea of “assembling a good team.”

A fourth component of the Foundation’s theory of action is that actors up and down the system need to acquire relevant knowledge and skill, for no professional development program will “stick” without aligned reforms throughout the schools and their districts. And so principals were invited to institutes and are expected to learn about the writing process and performance assessments. District leadership was also kept regularly informed about the problems and progress of the initiatives. Given this systemic view, the Foundation believes that all educators, at all levels of the system, need some knowledge in four domains: leadership, content, systems, and pedagogy. However, the depth, content, and character of that knowledge varies according to one’s role: district staff, school principals, coaches/mentors, and teachers. For example, teachers need extensive knowledge of subject matter and pedagogy (instructional strategies and assessment tools, for example). And while they also need knowledge of leadership, school principals need more extensive knowledge of leadership (the role of vision, for instance, or the use of disequilibrium/dissonance to stimulate change) and systems (organizational theory or development, ecology of systems, for instance). This focus on the entire system resonates with the work of scholars who argue that, as Newmann, King, and Youngs (2000) note: “professional development is more likely to advance achievement of all students in a school if it addressed not only the learning of individual teachers but also other dimensions of the organizational capacity of the school” (p. 260).

This systemic conception of capacity building for innovation is represented in Figure 3.3:

![Figure 3.3. A Systemic Approach to Education Professionals’ Development (Gerstein, n.d.)](image)

The Foundation staff conceptualized the reform problem as such: One has an aim (to establish effective literacy and mathematics instruction) and a set of associated challenges (develop teachers’ capacity, develop organizational capacity, etc.). To meet the goal, given those challenges, one has “theories of action” (a coherent literacy program, strong administrative leadership, exemplary teachers and schools, for example); flowing from those theories are “strategies” (offering high quality professional development, providing high quality assessments). A central strategy was to require that districts back the rhetoric of their program support with resources as well (often referred to as “commitments”): coaches are supported with funds both from the Foundation and from the participating school districts. This reflects a fifth feature of the Foundation’s theory of action: educational reform requires that outside agents (like a Foundation) help participating schools and teachers build the infrastructure, knowledge, skills, and commitments necessary to sustain a program once the extra funding is removed. To make this assumption explicit, the Foundation staff

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This diagram is not meant to suggest that the Foundation does not understand the interactions between these domains (for instance, pedagogical content knowledge). However, for the sake of simplicity, the domains are represented here as separable.
consistently explicated “commitments” for itself and for participating districts. For example, for the school year 2003-04, schools that participated in ECRW agreed to the following set of commitments:

<table>
<thead>
<tr>
<th>Noyce Commitment</th>
<th>District and School Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Noyce Foundation will provide:</td>
<td>Develop a coherent plan and demonstrate progress in implementing improved literacy programs within the district by:</td>
</tr>
<tr>
<td>1. partial funding for a coach in the exemplar school;</td>
<td>1. maintaining a high level of practice in the exemplar school</td>
</tr>
<tr>
<td>2. a specified amount of additional funding for literacy resources;</td>
<td>2. utilizing the exemplar school to support professional development within newly implementing schools;</td>
</tr>
<tr>
<td>3. a menu of staff development resources;</td>
<td>3. showing annual progress by implementing in additional sites;</td>
</tr>
<tr>
<td>4. tools to support implementation;</td>
<td>4. demonstrating improved literacy achievement;</td>
</tr>
<tr>
<td>5. consultant services and technical support; and</td>
<td>5. coordinating professional development within the district;</td>
</tr>
<tr>
<td>6. initial coordination of activities across core districts and schools.</td>
<td>6. assuming increasing responsibility for coordination and support of the initiative.</td>
</tr>
<tr>
<td>as long as the school and district meet their commitments and make progress in implementation.</td>
<td></td>
</tr>
</tbody>
</table>

But the Noyce Foundation does more than sponsor professional development programs, and so there are also a set of relevant values and operating principles that are worth noting. We conclude our description of these programs with a brief analysis of the values and principles that the Foundation uses for its work.

**The Noyce Foundation’s Core Values and Operating Principles**

*All over America there are lively, hopeful, ambitious students who want to get an education, make a good life for themselves, and create and contribute to our society. Too many of them live with school and family circumstances that prevent them from reaching their dreams. And those circumstances are not changing fast enough. We are dedicated to finding ways to create opportunities – inside and outside of schools – to reach those children even as we work to improve the public education system as a whole.* (Noyce Foundation, 2004, p. 4)

ECRW and SVMI, as programs envisioned and supported by the Noyce Foundation, are animated by a distinctive set of core values and operating principles held by that Foundation.

Following the commitments and vision of Robert Noyce (cf. Berlin, 2005), the Foundation holds dear a set of core values: that accomplishment is fundamentally tied to optimism; that innovation depends on creativity and risk taking; that excellence depends on determination to reach high levels of achievement; that change only happens when one commits to stay the course and demonstrates the patience necessary for fundamental progress; and that flexibility is necessary so that one might respond to new opportunities and changing circumstances (Noyce Foundation, 2004).
The Foundation’s work is also built upon a set of operating principles adduced both from the example of Robert Noyce and from knowledge and experience with innovation and reform in industry and education. The guiding principles include:

⇒ Building community
⇒ Focusing on content
⇒ Investing in professional development
⇒ Fostering leadership
⇒ Focusing on results

It was in the context of these two programs – and their clearly articulated values, theories of action, and commitments to hopefulness and optimism, élan and good will, focus and accountability, data and inquiry, professional development and system-wide learning – that we investigated whether and what teachers were learning. Before presenting our results, we briefly describe our research methods.
Part 4:
Method

Research Questions

In November of 2001, at the Foundation’s behest, we began an investigation of two “content-rich” professional development programs sponsored by the Noyce Foundation: the Silicon Valley Mathematics Initiative and Every Child a Reader and Writer. The purpose of this study was to gather evidence about what teachers were learning (or not) within those two programs. The research questions included:

⇒ What opportunities do teachers have to learn in these professional development programs?
⇒ What do teachers learn about mathematics or writing, students and their learning, and instructional strategies from these professional development programs?
⇒ What program features account for this learning?
⇒ In particular, what is the role of coaching? What is the role of the performance standards and assessments? The principal?
⇒ What behaviors do teachers and their students engage in during instruction?

Our purposes were multiple. First, we aimed to provide the Noyce Foundation with evidence concerning the effects of their programs on teachers’ professional knowledge and skill. Second, we aimed to contribute to research on teacher learning and professional development by (a) providing thick descriptions of two coherent and comprehensive professional development programs; (b) analyzing the opportunities for teacher learning that each program provides; (c) describing what teachers learned (or did not) in and through those opportunities; and (d) hypothesizing about the relationships between professional development opportunities, teacher learning, and—to the extent it was possible—student learning. Third, we proposed to contribute to theorizing about professional development and the resources it takes to enact these new visions of professional development.

Design

The study involved multiple sites and multiple methods. We studied each program, as well as 6 participating teachers in depth within each program. Our methods for this part of the research were largely ethnographic. Our fieldwork allowed us to develop thick descriptions of teachers’ practices, teachers’ perspectives on their own learning, professional development opportunities, and the Foundation staff members’ intentions and hopes.

Teacher case studies. We interviewed and observed six teachers in each program for over two years. Each teacher was visited between three to six times each school year between November 2001 and December 2004. Semi-structured interviews were conducted at the beginning and end of each school year (these lasted between 30-75 minutes); pre- and post-observation interviews were conducted around each observation (these lasted 5-30 minutes). The case study teachers were also shadowed through critical program events. Coaches who worked with the teachers were also interviewed when possible; in a few cases, we observed coaches working with these teachers in their own classrooms. All interviews were transcribed, all field notes were written up, and summaries of each were also developed for ease of sorting through the data. For each teacher, we had somewhere between 100 and 500 pages of data in the form of interview transcripts, field notes, and documents collected from their classrooms.
Program case studies. As already noted, each program is a complex of summer sessions and institutes, Saturday workshops throughout the school year, on-site coaching, monthly meetings, school-based meetings (including visits to exemplary teachers), scoring sessions for student assessments (performance assessments and portfolios, for example). We observed many of the central events multiple times, documenting the opportunities to learn that each presented to teachers. We also repeatedly interviewed the program directors and staff. Leaders of both programs were generous with their time and materials, and provided us with documents that were used in many program activities as well. This included providing us access to the websites for each program, and keeping a running record of relevant paperwork that we might find useful. For each program, we had over 5000 pages of field notes, interview transcripts, and documentation.

Surveys. To situate our thick descriptions of the programs and teachers in the broader landscape of participants’ experiences, we also administered a teacher survey in the spring of 2003 and 2004, as well as a mentor/coach survey. The survey focused on opportunities for teacher learning. A pilot survey was developed and administered for ECRW in the spring of 2002. The final survey was administered to both teachers and coaches in ECRW and SVMI/MAC in the spring/early summer of 2003 and 2004. For ECRW, there were 244 participants in 2003 and 357 participants in 2004. For SVMI, where participation in the survey was less than optimal, there were 77 participants in 2003, and 98 in 2004. (See Wilson and Mapuranga (2006) for technical reports of those surveys, including copies of the surveys themselves.)

In terms of selection bias, clearly the case study teachers were volunteers, which might mean that they had certain characteristics (e.g., they might be especially pleased with the program or they had a particular complaint about professional development that they wanted to express or they were in schools where principals were particularly supportive of the research). However, we worked with the Noyce Foundation staff to identify teachers who were at various stages of implementation: we did not want to limit the case studies to teachers who were “high implementers,” to use the language of ECRW. Nonetheless, given their voluntary stats, it is not likely that we identified and met with teachers who were disgruntled about the reforms, or unengaged with the ideas.

In terms of the survey, ECRW surveys were distributed through principals at participating schools. This accounts for the relatively high participation rates. We had a more difficult time distributing surveys to SVMI teachers, largely because the reform is not a whole school reform in which all teachers participate in the same way as in ECRW (whole schools use the MARS assessments but not all teachers are actively involved in summer institutes, or the Mathematics Network for example. In 2003, we distributed teacher surveys to coaches during one of the coaching meetings. Coaches were asked to encourage their teachers to fill them out and mail them back to us in envelopes, give them to David Foster or other Foundation staff, or return them to the coaches themselves. Thus, the more responsible and “on-board” coaches pressed their teachers further, reminding them to send in the survey. Teachers who were too busy, distracted by other work, less engaged in SVMI, or working with coaches who were suspicious or disinterested in the research could easily throw the survey out.

In 2004, we tried a different strategy and administered the survey as part of one of the summer institutes (one where there were approximately 200 or so teachers and coaches in attendance). Participants were given time to fill the survey out at the institute and the surveys were collected there. In that administration, the biases from the first round of the survey are equally relevant, although perhaps there was less distraction. However, the sample was limited to participants in the summer institute, which might have introduced additional bias as well. The respondents might have been more enthusiastic about professional development (enough so that they gave summer
Student data. Both programs collect large quantities of student learning data in the form of mathematics assessments and student writing. In addition, all schools participate in California’s statewide student testing program. We had access to all of those data as well, although at no time did we have access to data that would allow us to connect student achievement with particular teachers.21

Data Analysis

All interviews were transcribed and coded for opportunities to learn, challenges for professional development, and writing/mathematics. Field notes were written for classroom observations and professional development events. In-depth case studies of teachers and the two programs were drafted, and preliminary cross-case analyses of the opportunities for teacher learning and the challenges faced by professional development were conducted. Patterns were identified both through multiple collective readings of the data and through bi-monthly staff meetings. Four analysts read all of the ECRW interview and observational data and three analysts read all of the SVMI data, which allowed for on-going discussions concerning differences in interpretation. In addition, annual reports were submitted to the Noyce Foundation, at which time program staff reacted to, disagreed with, and discussed preliminary findings. Presentations were also made at annual meetings of the American Educational Research Association and the National Council for Teachers of English. These allowed us to offer and test out preliminary analyses for critique and reaction by interested researchers.

By conducting careful, repeated readings of the case study interview data, we were able to examine teachers’ opportunities to learn in some depth. Using a grounded theory approach (Glaser, 1992; Glaser & Strauss, 1967; Miles & Huberman, 1994), we identified the teachers’ various learning opportunities and looked for changes (or the lack thereof) in teachers’ knowledge, beliefs, and practice within and across teachers. Patterns that were identified in the interview and observational data were then tested with the survey data. We were particularly interested in discovering what the teachers learned from each program and how the various components of the professional development programs contributed to or detracted from the teachers’ learning.

Once we identified patterns and potential relationships in both the observational and survey data, we used regression analyses to test for significant relationships more generally. These analyses are described in the technical report for the surveys (Wilson & Mapuranga, 2006).

21 Due to resource restrictions, we were not able to construct independent measures of student learning, or collect those data. However, we did have access to all student learning data collected by the programs themselves, including state level assessment data on participating schools and program-specific assessment data. We drew heavily on analyses of these data by Educational Data Systems (2003, 2004, 2005), Foster (2005), Foster and Noyce (2004), and the Noyce Foundation (2004, 2005).
Access and Other Methodological Challenges

When we began this research project, it appeared to be an ideal project in terms of access. Funded by the Foundation that was sponsoring the programs we were investigating, we anticipated and were promised full access to materials, insights, and information that would enhance the research.

But nothing is ever that simple and we note here a handful of challenges that we confronted while conducting the research. The first regards the staff's understanding of the purposes of the project. The project was conceptualized as a piece of research, not an evaluation. As Scriven (2003/2004) explains, “Evaluation determines the merit, worth, or value of things. The evaluation process identifies relevant values or standards that apply to what is being evaluated, performs empirical investigation using techniques from the social sciences, and then integrates conclusions with the standards into an overall evaluation or set of evaluations.”

Research, on the other hand, does not aim to judge whether something is right or wrong, good or bad. Instead, it is aimed at observing phenomena, describing and measuring them, and offering descriptions of empirical/observable events. Our goal in this research was to use these two professional development programs as sites for (1) describing “content-rich” professional development and (2) describing what teachers learn (as reflected in what they did in their classrooms and what they reported about their own learning in surveys and interviews).22

Clearly, the line between evaluation and research can be -- and often is -- blurred. In the case of this research, some staff thought of this research as an evaluation. This is understandable: As significant investments of resources, staff and interested others (for instance, trustees) would be interested in using the empirical research to inform their deliberations about the quality of their investments in SVMI and ECRW. That was not, however, our purpose as researchers. This conceptualization of this research as evaluation served to complicate our research at times. This too was understandable, for any time outsiders observe one's work, one worries about what judgments are being made. Nonetheless, this misunderstanding was unfortunate. Questions were raised about whether we had selected the “right” case study teachers (not all of the teachers were interviewed and observed were “high implementers” -- one SVMI staff member thought we ought only study teachers who fully embraced the reforms); negotiations were extremely difficult concerning both the content of the SVMI survey and its administration (leading to very low participation rates). When interviewed about the challenges they faced in creating educative opportunities for teachers in running these programs, most of the staff were forthcoming (which led to rich conversations about professional development and helpful insights into how and why the programs were changing), but at least one staff member repeatedly glossed over difficulties, focusing always on increased student test scores and the number of participating teachers and schools. This made it more difficult to communicate about when and why the program was changing.

22 We are aware that the more recent emphasis on double-blind, random assignment experimental studies for gathering information on the effectiveness of various instructional and professional development programs blurs the line between evaluation and research even more. However, as researchers, our own conception of research is more informed by the work of Weber (1949), among others, who emphasized the role of researcher in social science research, and the impossibility of removing values and presuppositions from any research. Furthermore, Weber argues, it is job of the researcher to describe and explain why something happens, not to make decisions about policy or new steps in practice.
A second methodological challenge concerned the programs’ constantly changing character. Both programs had, as part of their core precepts, a commitment to institutional learning based on lessons learned from previous years. While this was true of both programs, it was especially true of ECRW since that program was in its early stages of development when we began this research. The program churning posed an important methodological challenge. When attempting to assess the effects of a program, fundamental changes in the program compromise one’s ability to claim effects; inconsistencies in program or “treatment” implementation can be serious threats to a study’s internal validity (cf., Campbell & Stanley, 1963). If a professional development program does not, for example, follow “prescribed procedures” or if procedures (like how to coach) are inconsistently carried out, it is harder to observe the “true” relationship between the program and its outcomes (in this case, between the opportunities to learn offered by both programs and what teachers learned). To extend the coaching example, both programs experienced considerable variability in what “coaching” meant – at one given time and across time. This was due to many factors – coaches had different levels of knowledge and experience, as well as different beliefs about their roles; the Foundation gave varying degrees of guidance over time; and the programs changed how they conceptualized and then educated coaches for their roles. Thus, this part of the “treatment” varied within and across time, which compromises the validity of the research reported here.

The churning also led to a shortened shelf life for many of our analyses, due in large part to continued communication between the research team and the staff. When, for instance, we observed that the coaching model used by SVMI was not as structured as that used by ECRW, the next year, SVMI had a different approach to the education of its coaches and the amount of explicit guidance provided to coaches about how to do their work. Thus, our “findings” about coaching were no longer valid.

A third methodological challenge concerned the potential or perceived conflicts of interest inherent in being a research project funded by the same Foundation that was funding the professional development. We were introduced to SVMI and ECRW participants by the Foundation, and for many participants, this meant that it was unclear whether we were a part of “Noyce” or independent. Because the programs both had characteristic belief systems about writing and mathematics instruction (often referred to by participants as “the Noyce way”), participants were not always sure that they could share their honest opinions with us. For instance, they did not know whether we too were “believers” in whatever they mean when they referred to “the Noyce way.” Noyce poured considerable resources into the schools and systems in which teachers worked, and for that, most participants were genuinely grateful. No one wanted to alienate the funder, even when they disagreed with aspects of the core tenets of each program. Furthermore, because we were interested in assessing teachers’ knowledge of content and teaching, and because each program was perceived as having a particular teaching philosophy (again, the Noyce way), teachers were of the mind that there was a “right answer” to questions we posed about teaching. That is, when we constructed survey or interview questions designed to get at how teachers thought about teaching mathematics or writing, the participants knew how the Noyce program staff would “like” them to answer questions. Despite our repeated attempts to persuade them that we had no investment in “the Noyce way” and that their honest responses would be both helpful and treated with confidentiality, we were constantly reminded that our positions as researchers were genuinely and justifiably confusing or ambiguous to many participants.

This became most painfully obvious when we received a complaint from a teacher in an ECRW school. We had arranged for the surveys to be administered by an adult who was not associated with each school; but in one school the principal administered the surveys and then took them to her office. Because there were open-ended items on the surveys, the principal would have been able to identify the handwriting of which teacher answered which survey. One teacher contacted us, concerned that her...
skepticism about some of the ECRW "rules" put her in jeopardy. (In fact, she had even
attached a research report for our perusal that discussed findings that were not all
aligned with Noyce assumptions about the teaching of reading and writing.) While the
lapse in data collection was readily resolved (the initial surveys in that school were
destroyed and the survey was readministered, all according to institutional review
board policy), we were reminded of how — any time a reform has a clearly articulated
normative view of teaching and learning — researchers' capacity to get honest responses
from teachers about their commitments to and ideas about that reform are
compromised. This was true in both ECRW and SVMI where teacher participants
frequently spoke of "the Noyce way."

Another challenge concerned our attempts to assess participants' knowledge of
content. As has been documented by other researchers, we faced considerable
difficulties in both developing assessments of teacher subject matter knowledge, and
cajoling teachers to participate in such assessments. Teachers almost unilaterally
skipped items on our surveys that were designed to assess their content knowledge of
writing and mathematics; in interviews we were wary about asking "test" questions
since the teachers who worked with us were quite explicit about their insecurities about
their content knowledge and we did not want to lose them as research participants due
to insulting, challenging, or frustrating questions. In the end, we had to rely on very
weak proxies — mainly teacher self report — of gains in their subject matter knowledge
and confidence. We supplemented those forms of data with firsthand observations of
case study teachers in professional development meetings and in their classrooms. But
making inferences about what a teacher knows about mathematics or writing by
"reading between the lines" of how she talks with her colleagues or students about that
content is equally fraught with difficulties.

One final methodological challenge involved the conflicting pulls of teachers' time
in these schools. Not only were participants asked to do professional development on
top of their teaching, but they were working in a policy climate in which there were
increasing calls for accountability. This meant that each year of the study, teachers
were asked to do more by way of assessing student achievement and preparing students
for those tests. The pressure of meeting the time demands for professional development
and the policy demands of a NCLB world of schooling shaped teachers' interests in and
enthusiasms for participating in this research. We managed to hold on to all of our case
study teachers throughout the study (save for one ECRW teacher who left the
profession), but SVMI participation rates in the survey were low, and we had to scale
back the length of both surveys in the second administration in order to ensure
reasonable participation rates. For this reason, some survey items are not comparable
across years of survey administration.

We will return to several of these challenges at relevant points in this report. We
now turn to our results, which are presented in three major sections. First, we examine
— in broad strokes — what teachers learned from the two professional development
programs (Part 5). Second, we examine the opportunities to learn that they participated
in (Part 6) and relationships between those opportunities and what they learned (Parts 6
and 8). Along the way, we also describe a set of factors that shaped the quality of
teachers' implementation of these two reform efforts (Part 7).
Part 5:
What Do Teachers Learn?

Unfortunately, most of the literature on professional development tells us little about what teachers learn from such experiences. The reasons behind this lack of adequate research are multiple: poor funding for such studies, a history of evaluations that traditionally asked teachers whether they found something helpful, a lack of adequate theory for understanding what we would expect the effects of professional development to be, a lack of adequate professionally responsible and publicly credible measures of what teachers learn, and the tensions inherent in testing teachers in an age of increasing accountability (Wilson & Berne, 1999).

One goal of this project was to explore varied methods for capturing what teachers learned, and we approached the question in multiple ways. First, each field worker kept careful notes of classroom conversations that teachers had with students, and conversations that teachers had among themselves during professional development events. Second, interviews were designed to directly and indirectly ask teachers about their experiences in SVMI and ECRW and what they were learning through those. Third, to the extent possible, we shadowed case study teachers through their professional development experiences. Finally, we asked survey respondents about the effects of these programs on their professional knowledge and skill. In the case of SVMI, we also had access to data that were collected by Heather Hill, Deborah Ball, and their associates at the University of Michigan about teacher learning in the summer mathematics professional development workshops. We also had access, through staff, to the feedback elicited from participants in some components of both programs.

No one of these methods we used was satisfying to us, for reasons that we discuss later in this report concerning the methodological implications for researchers and professional development staff. However, across the various forms of data, we did identify several patterns, which we describe here. We will start with the survey data before moving to the analyses of the case study teachers’ learning over time.

Survey Respondents

ECRW. As “content-rich” professional development programs, both ECRW and SVMI hold dear the idea of what we have called “disciplinary engagement,” that is, a commitment to giving teachers experiences writing and doing mathematics as part of their professional development. The assumption is that the disciplinary awareness and ease that comes from “doing” the subject matter will directly translate into content knowledge and directly affect teachers’ abilities to teach that subject to students.

Given these commitments, we asked survey respondents both about changes in their attitudes and behavior as writers, as well as about their attitudes and behavior as teachers of writing. Respondents reported that they were more confident both as writers and as teachers of writing (see Table 5.1.). They reported that they enjoy writing and the teaching of writing more. The results are more favorable for their confidence and enjoyment in the teaching of writing than in writing: more teachers disagreed with the statement that they were more confident as a writer than they did with the statement that they were more confident as a teacher of writing. One sees a similar pattern with respondents’ enjoyment of writing (26–27% of teachers disagreed with this statement) versus their enjoyment of the teaching of writing (only 11–15% disagreed with this statement).
<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy writing more</td>
<td>7.0</td>
<td>2.4</td>
<td>25.6</td>
<td>27.8</td>
</tr>
<tr>
<td>I am a more confident writer</td>
<td>4.2</td>
<td>0.9</td>
<td>28.3</td>
<td>28.4</td>
</tr>
<tr>
<td>I write more often</td>
<td>6.3</td>
<td>3.1</td>
<td>38.8</td>
<td>32.4</td>
</tr>
<tr>
<td>I enjoy teaching writing more</td>
<td>5.0</td>
<td>2.7</td>
<td>15.3</td>
<td>10.1</td>
</tr>
<tr>
<td>I am more confident about teaching writing</td>
<td>1.6</td>
<td>0.0</td>
<td>8.2</td>
<td>9.8</td>
</tr>
<tr>
<td>I want to learn more about the teaching of</td>
<td>1.2</td>
<td>0.0</td>
<td>6.6</td>
<td>7.4</td>
</tr>
<tr>
<td>professional literature</td>
<td>4.2</td>
<td>1.5</td>
<td>18.3</td>
<td>16.2</td>
</tr>
<tr>
<td>I read more professional literature</td>
<td>3.8</td>
<td>0.6</td>
<td>15.1</td>
<td>16.5</td>
</tr>
</tbody>
</table>

Table 5.1. Survey Responses to Questions about the Effects of ECRW

Where one sees the strongest agreement is in teachers’ enthusiasm for the teaching of writing, their interest in learning more about the teaching of writing, and their appetite for reading both children’s literature and professional literature. In all of these cases, for both 2003 and 2004, more than 80% of teachers reported an increase in their interests in and enthusiasms for writing and the teaching of writing.

What seems clear is that teachers feel the effects of ECRW close to the classroom: reading professional literature, learning more about teaching, and enjoying teaching more. While they also report some increased confidence as writers and an increase in how much they themselves actually write, teachers showed more ambivalence in those domains; between 35-42% disagreed or strongly disagreed with the statement that they wrote more after joining ECRW and 29-32% disagreed or strongly disagreed with the statement that they felt more confident as writers.
SVMI. One sees similar results for SVMI. When asked whether they enjoyed mathematics more, 85% and 77% of respondents in 2003 and 2004 respectively either agreed or strongly agreed with the statement (see Figure 5.2); 88% and 80% agreed or strongly agreed with the statement “I enjoy teaching mathematics more.” Confidence increased as well, with 89% and 87% of respondents (again, in 2003 and 2004 respectively) either agreeing or strongly agreeing with the statement “I am a more confident mathematical thinker” and 87% and 77% with the statement “I am more confident about teaching mathematics.” These results resonate with those of Weiss and Pasley (2006) who found that teachers who participated in the Local Systemic Change program sponsored by the National Science Foundation reported increased confidence both in their content and pedagogical preparedness, and “more participation meant a greater sense of preparedness” (p. 6).

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy mathematics more</td>
<td>0%</td>
<td>2.1</td>
<td>6.6</td>
<td>12.4</td>
</tr>
<tr>
<td>I am more intimidated by teaching</td>
<td>42.1</td>
<td>40.8</td>
<td>48.7</td>
<td>42.9</td>
</tr>
<tr>
<td>mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am a more confident mathematical thinker</td>
<td>0.0</td>
<td>0.0</td>
<td>3.9</td>
<td>14.3</td>
</tr>
<tr>
<td>I enjoy teaching mathematics more</td>
<td>0.0</td>
<td>0.0</td>
<td>4.0</td>
<td>6.2</td>
</tr>
<tr>
<td>I am more confident about teaching</td>
<td>0.0</td>
<td>1.0</td>
<td>5.3</td>
<td>14.3</td>
</tr>
<tr>
<td>mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I want to learn more about mathematics and</td>
<td>0.0</td>
<td>0.0</td>
<td>1.3</td>
<td>2.0</td>
</tr>
<tr>
<td>the teaching of mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.2. **SVMI Participants’ Self-Reports of the Effects of SVMI**

Teachers’ appetite for learning more about mathematics and the teaching of mathematics also increased: nearly all respondents (over 93% in 2003 and 94.9% in 2004) agreed or strongly agreed with the statement: “I want to learn more about mathematics and the teaching of mathematics.”

We also asked the SVMI respondents about particular kinds of knowledge and skill they might develop through their participation in SVMI. When asked, “To what extent did SVMI help you to develop your understanding of the following?,” respondents reported the highest impact (over 50% of the respondents) on (a) their ability to encourage students to share their mathematical ideas (67% and 72% respectively in 2003 and 2004 checked a 4 or 5 (very well) on a 5-point Likert scale); (b) their use of teaching strategies that promote student inquiry (63.7% and 59.4% checked a 4 or 5 on the same Likert scale); and their ability to encourage students to revise their thinking as they justify or generalize an argument (58% and 54% percent respectively).

These results resonate with the American Institutes for Research (2002) evaluation of the California Subject Matter Projects (recall that a significant proportion of SVMI’s activities are done in conjunction with one such subject matter project). Those evaluators found, in longitudinal analyses, that “after participating in CSMP, there is a significant increase in the frequency with which teachers have students explain their reasoning” (p. 28).
Table 5.3. Survey Responses to Questions Concerning Impact of SVMI on Teaching Knowledge and Skill

<table>
<thead>
<tr>
<th></th>
<th>Not At All</th>
<th>2</th>
<th>Adequately</th>
<th>4</th>
<th>Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encouraging students to share their mathematical ideas with the class</td>
<td>9.1</td>
<td>3.3</td>
<td>0.0</td>
<td>4.4</td>
<td>23.4</td>
</tr>
<tr>
<td>Using teaching strategies that promote student inquiry</td>
<td>9.1</td>
<td>2.2</td>
<td>6.5</td>
<td>6.6</td>
<td>20.8</td>
</tr>
<tr>
<td>Encouraging students to revise their thinking as they justify, generalize and develop sound arguments</td>
<td>7.8</td>
<td>1.1</td>
<td>5.2</td>
<td>5.6</td>
<td>28.6</td>
</tr>
<tr>
<td>Understanding the concepts, knowledge, and skills necessary to teach mathematics</td>
<td>7.8%</td>
<td>3.4</td>
<td>7.8</td>
<td>13.5</td>
<td>29.9</td>
</tr>
<tr>
<td>Maintaining an orderly, purposeful learning environment for mathematics instruction</td>
<td>10.4</td>
<td>3.3</td>
<td>11.7</td>
<td>20.0</td>
<td>28.6</td>
</tr>
<tr>
<td>Choosing different teaching strategies for different instructional purposes</td>
<td>9.1</td>
<td>4.4</td>
<td>6.5</td>
<td>20.0</td>
<td>35.1</td>
</tr>
<tr>
<td>Setting appropriately challenging expectations for students</td>
<td>7.8</td>
<td>1.1</td>
<td>11.7</td>
<td>11.4</td>
<td>29.9</td>
</tr>
<tr>
<td>Knowing how to find/create resources for use in teaching mathematics</td>
<td>13.0</td>
<td>7.9</td>
<td>10.4</td>
<td>25.8</td>
<td>29.9</td>
</tr>
<tr>
<td>Using a variety of assessment methods</td>
<td>7.9</td>
<td>9.0</td>
<td>15.8</td>
<td>33.7</td>
<td>30.3</td>
</tr>
<tr>
<td>Understanding how different students learn mathematics</td>
<td>10.4</td>
<td>4.4</td>
<td>15.6</td>
<td>20.0</td>
<td>28.6</td>
</tr>
<tr>
<td>Developing mathematics lessons and units</td>
<td>11.7</td>
<td>6.7</td>
<td>11.7</td>
<td>41.1</td>
<td>36.4</td>
</tr>
<tr>
<td>Teaching students mathematical conventions</td>
<td>11.7</td>
<td>10.1</td>
<td>10.4</td>
<td>27.0</td>
<td>39.0</td>
</tr>
</tbody>
</table>

Teacher-respondents also reported that SVMI improved their understanding of mathematical concepts and skills necessary to teach mathematics, their ability to maintain an orderly learning environment; their ability to choose different teaching strategies for different instructional purposes, their ability to set appropriately challenging expectations for students, their understanding of how students learn mathematics, and their ability to develop lessons and units. Again, AIR (2002) found similar results in its evaluation of the CSMPs, with over 70% of teacher reporting a substantial effect on deepening their understanding of the subject matter. Data on teacher learning in the summer institute portion of SVMI were also collected by the
Learning Mathematics for Teaching Project at the University of Michigan as part of an evaluation of the California Mathematics Projects. In 2003-04 years, 77 teachers took both pretest and posttest. Their average score for the 23 geometry items that overlap on the two forms was 16.93 (sd=4.20) for the pretest and 17.66 (sd=3.53) for the posttest. When the scores are standardized, this results in an average change of .17 and the t(2, 76) = -3.01 which is significant p<.01. In 2004-2005, there were several serious problems with the data (mismatched ID numbers, more people taking the posttest (110) than the pretest (57), teachers not answering all of the questions, and teachers doing worse on one of the three items that linked the two forms. For the 53 teachers whose tests could be used for the analysis, there was a very small, negative gain. When six teachers' scores were dropped because the increases were unusually extreme, there was a small, positive gain, but not significant for the Numbers Concepts and Operations Scale. Teachers' scores on the Geometry Scale were higher, and showed a significant improvement when the six extreme teachers were dropped. Thus, for SVMI, in the first year there was evidence that teachers gained content knowledge; in the second year of the assessment administration, the evidence was less clear.

Case Studies

Surveys are notoriously limited in what they can reveal about teachers' learning, and so we also analyzed interview and observational data for insights into what teachers learned. Based on the in-depth case study data, what teachers learn in and from these programs appears to cluster into three domains: (1) knowledge of and skill in subject-specific classroom practices; (2) subject matter knowledge, including understanding of the "what" and "how" of mathematics and writing; and (3) their understanding of teaching as a profession and its attendant obligations.

Understanding Subject-Specific Classroom Practices

My first year here, I was an assigner. I assigned writing, I didn’t teach writing. (ECRW teacher)

First, in both programs, teacher-participants appear to change the ways in which they think about teaching. This is no surprise, since both SVMI and ECRW have underlying assumptions about what “good” mathematics and writing teaching and learning looks like. Consider the questions on the SVMI classroom observation guide that coaches use as a tool to structure their conversations with teachers:

- Are students grasping the conceptual understandings of the mathematics?
- Is there depth in the activities students are engaged in?
- How are students using mathematical reasoning?
- What conjectures have students made?
- What justifications are students sharing?
- How does the teacher use the reasoning of students?
- How does the teacher facilitate/encourage student connections?
- How is higher-level reasoning supported in class?
- How is proof and justification facilitated and encouraged?
- How well do students talk to one another?

23 This research was conducted on what one might call the “cusp” of the field of research on teaching learning’s understandings of the resources it takes to measure such learning. In this study, we used methods that had been used traditionally – both surveys and interviews/observations. More recent work in the development of instruments for teacher learning is afoot and holds promise for producing much more satisfying measures of what teachers know and learn in professional development (see, for example, Hill & Ball, 2004; Hill, Rowan, & Ball, 2005). We discuss these methodological implications in our conclusions.
How well do students listen to one another?
Where does the authority of the mathematics reside in the class?
Are students willing to take risks?
What does the teacher do to support student centered thinking?
Does the teacher encourage students to use others as resources?
Does the teacher make math reasoning the authority in the class?

These and other questions send a clear message as to the kind of teaching SVMII coaches and other staff hope to see: Teachers asking students to dig into the conceptual aspects of mathematics; students taking responsibility for much of the classroom discourse, students taking risks, making conjectures, listening to one another, and relying neither on the textbook nor the teacher for the “answer” to a mathematical question.

ECRW sends a similar message about teaching. Consider the dimensions of the *Writer’s Workshop Implementation Scale (WWIS)*, a guide that was sometimes used to locate individual teachers on a developmental scale of the extensiveness of their implementation of the ECRW ideas and practices (recall that this scale was used to determine implementation level of teachers for the analysis of student achievement data).25 Teachers are judged as highly effective when “student thinking and ideas are valued and they feed the energy of the classroom,” “when touchstone books are well known by the teacher and students,” and used routinely. Teachers are also judged highly effective when they function as “facilitators for student learning because students work independently” and when they “focus on moving students toward mastery of the standards while honoring students’ individual goals as writers”; they also move “beyond the assumption that there is only way to be successful.” The *WWIS* also clearly delineates the character and content of a highly effective mini lesson, closings, and other specific practices of writer’s workshop.

Again, the image of good teaching and learning is clear. Students and teachers have their roles, *both* have responsibility for the quality of the classroom experience. Teachers respect students and their ideas, while also making sure that they master important content – genres, author studies, developing certain writing skills, etc. There is room to take risks, to pursue one’s own interests. Teachers, as is the case with SVMI, are committed to gathering information – in the form of informal and formal assessments – of student progress, and this information guides the next steps they take. Just as their students learn to list “noticings” about texts, so ECRW teachers learn to make “noticings” about their students.

It is not an accident that, although both programs are subject-specific, and teachers learn a lot about writing and mathematics, the programs share some common views of education. As mentioned previously, the Noyce Foundation was created to

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25 The *WWIS* was originally developed by Sally Hampton in response to the expressed need of coaches for a tool to support their assessment of how well individual teachers were doing with their implementation of ECRW ideas. Audrey Poppers took that original tool and, along with the coaches, expanded it considerably. Not surprisingly, because the reform and its ideas are complex, so too was the *WWIS*, which became so large that it ceased to be a helpful guide for observing practice. (In one case, when a coach shared part of the *WWIS* with school staff, teachers worried that they would *never* be able to achieve the status of high implementer given the complexity of those descriptions.)

More problematic still was the fact that most teachers were unaware of being given a score (this information was not withheld intentionally, but the scale was not a tool used by coaches and teachers, but rather among coaches and staff). The ECRW staff continue to struggle with both how to use such a tool, and the most effective level of detail for such a guide. We return to this issue in the concluding sections of this report.
commemorate the life of Robert Noyce who himself valued risk-taking, creativity, “thinking outside of the box,” and independence. He too was concerned about ways in which organizations can and do – intentionally not or – alternatively inhibit or empower the creative and imaginative work of individuals. As previously explained, the Foundation operates under a set of commitments, values, and principles that are aligned with this vision, including the need to build community; the importance of focusing on content; the equal importance of focusing on the system; the central role played by professional development; the need to foster leadership across the system; and the importance of focusing and judging one’s efforts on results. The view of education here is a progressive one in terms of creativity, innovation, and risk taking, grounded all the while in a clear commitment to getting results. Both professional development programs reverberate with those commitments.

As we have observed teachers over time, the way that SVMI and ECRW participants understand what it means to teach mathematics and to teach writing shifted noticeably, and in the educationally progressive direction that these professional development programs are pushing them. In the case of SVMI, teachers opened up the classroom discourse: Students were asked to explain their reasoning more often than in typical mathematics classrooms. Lani, one of our case study SVMI teachers noted:25

Since I’ve done lesson study, [there have been] major, major changes. I’m trying to talk less and that’s the key. It is to get kids more in charge of their own learning. So, giving them an assignment, and then allowing them to further explain. And I guess from watching the Japanese teachers, they keep saying, “I’m not quite sure what you’re saying, could you or someone else explain what’s happening to me?” Because then you get to see who understands it and what their perception is and who doesn’t get it. So yes, it’s not black or white anymore. It’s “why”?

In addition to asking students more questions and increasing the proportion of student talk during class discussions, SVMI teachers also appear to increase the instructional representations that they use to teach students about mathematical ideas. In SVMI, and, consequently, among the teachers who embrace its tenets, there is an assumption that there are multiple pathways through a mathematical problem, and that a range of representational tools might be useful in working out a solution. These tools include manipulatives (objects that students can move around or that teachers can put on an overhead), as well as various strategies for modeling problems. One such model that appears frequently in SVMI professional development is from a curriculum published in Singapore and is known by many participants as “Singapore boxes.” The boxes are a physical model meant to help students think about ratios. An example below shows how the boxes would be used to solve a ratio problem:

30 is 25% of what number?

To answer the question, the students would be given a “bar,” which is to be considered “the whole,” and they might mark it up as follows to help them think about the problem:

25 All teacher and school names are pseudonyms.
Another such model is the “pile pattern,” a graphical way to represent linear or quadratic growth. One example is:

Day 1:  
Day 2:  , etc.

This sequence can be found in Noyce classrooms from the third grade through middle school pre-algebra. What is done with them depends on the level, but in each case, the models are used to create an alternate, geometric representation of numerical growth. In the third grade classroom, students might try to predict how many triangles are in the shape on Day 3 or Day 4, or further. In a pre-algebra class, students might try to generate a rule that gives the number of triangles in terms of the day number. In this case, the rule would be \( y = 2x + 2 \).

In encouraging students to try multiple solutions and to try out several kinds of mathematical models, teachers also begin to allow errors into classroom discourse in ways quite different than the “try-and-give-the-right-answer” norms of traditional mathematics instruction. For SVMI teachers, classrooms are places where student errors are expected and used as opportunities to explore mathematics in deeper ways. As Jerry -- another case study teacher -- noted:

> I am trying to get students to model their thinking and understanding and their confusion. . . . I noticed a big change from what I had done in the past . . . . And so, I just thought that it really opened [my teaching] up and made it a lot different and more open . . . . And okay [for the students] to make mistakes, you know? A more comfortable classroom, in the sense that [the students] were valued; their ideas were valued more.

Teachers in SVMI also have an opportunity to use performance assessments of student learning, and their ideas about the role of assessment in their teaching also shift. They learn how to score assessments, as well participating in discussions concerning the outcomes of those assessments. Unlike many typical teachers who have -- at best -- an uneasy relationship with measurement, assessment, and data, many SVMI teachers eagerly dive into discussions of the assessments. They argue and debate interpretations of students' responses, they explore the mathematics, they think critically about how to change their instruction in light of what students can and cannot do on the assessments. Their work in understanding student performance on the assessments is aided by *Tools for Teachers*, the analysis of student performance developed by MAC director, Linda Fisher and a handful of coaches.

For some teachers these ideas are not new; rather, SVMI is an opportunity to continue thinking about mathematics the way they have for some time -- and it has given them the resources to actually realize some of their goals. Maggie Diamond, an experienced teacher and enthusiastic SVMI participant, was ideologically aligned with the program’s tenets. She shared its core beliefs that by emphasizing problem solving, visualization, and critical thinking, mathematics teaching can become a more effective, interesting, and equitable endeavor. Because Maggie shared those core values and has acted on them in various ways throughout her earlier teaching career (well before joining SVMI), she could promptly begin processing of all the curricular and pedagogical information that is presented to her in SVMI. In addition, Maggie’s voracious appetite for knowledge gave her the motivation to do something meaningful with what she learned. Her comments on her experience in the all-day professional development sessions reflect this readiness to learn:
And if I could say that there was one place that completely revolutionized my thinking, it was all of those . . . Saturday sessions. I'll never forget just huge turning points . . . I could go through the whole thing. I hardly looked up sometimes because . . . every word was so valuable to me.

Maggie is ready and willing to put in the time necessary to transfer new ideas such as these into her classroom. She is the ideal consumer for SVMI-related ideas, materials, and practices. She was ready to try anything.

Other teachers were more cautious, and for some of them, SVMI was their first opportunity to consider the ideas about classroom discourse, performance assessments, mathematical problems, and instructional tools embraced and disseminated by SVMI. For others, while they had encountered these ideas before, they worried about the conflict between ideas presented by SVMI and those reinforced by the California state standards and accountability system. These are issues we return to later in the report when we discuss factors that shape when and how ideas of these programs get picked up and adopted.

Similarly, we have evidence that ECRW changed the way that teachers thought about writing instruction. As previously discussed, ECRW involves implementing a form of writer’s workshop in elementary school classrooms. Drawing on the work of educators like Lucy Calkins (2001) and Katie Wood Ray (2002), teachers learn to teach mini lessons, in which they provide students guidance about strategies, “rituals and routines,” genre attributes, and conventions. They learn that mini lessons have an architecture: “connection, teach, try it, link.” Many of these verbs become nouns, as teachers suggest that students might want to work on some of their “try its.” During writer’s workshop, students write in their notebooks, share their work with partners in response groups, and conference with teachers. Conferencing also has a predictable sequence: “research, decide, teach.” Teachers keep records—sometimes elaborate—of student progress, which they then consult, both to keep track of individual students’ progress and to assess what instruction the class might need as a whole. Workshop lessons also have "closings": author's chair, "popcorn share," or "process-share" during which students read from their writing, “pop” up and volunteer an example of something all children were to be trying that day, or share the process by which they were working on their writing. ECRW assumes that the classroom culture is collaborative, and that teachers and students cooperate in the development of rituals and routines that allow students to take responsibility for their own learning and to be caring and responsive partners to other students. This independence frees the teacher up for the individual work of conferencing.

Reading is intimately related to writing and ECRW presumes that classrooms are literature-rich environments in which students also read extensively: Books are well known, well used, and easily available. “Touchstone books” are known and loved by the entire class; “mentor texts” are ones that students return to for their value in modeling particular craft moves, much like an adult might return to the work of an admired writer – Philip Roth or Toni Morrison, John McPhee or Anne Lamott – to examine their moves as writers for inspiration while writing. Students read books both for their content and as writers, noticing how an author used language, craft, and style for telling a story or making a point. In order to introduce genres, teachers “immerse” students in the genre by reading examples from professional and student writers. Students first develop charts together that represent the features that they notice about the genre. For example, in one class, students and their teacher generated the following chart for “5 Ways writers reveal what a character is like”:

26 In this sense, the touchstone and mentor texts served a role similar to that of the representational tools like Singapore boxes and pile patterns in SVMI.

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1. Tells directly: He was the oldest and toughest-looking kid in class.
2. Dialogue: "Give me a dollar or I'll sit on you."
3. Thinking/feeling: He understood it when the other kids were mean to him. It didn't bother him.
4. Actions: Bradley took out a pair of scissors and carefully cut his test paper into tiny pieces.
5. How others respond to a character: "No, not next Bradley!" a girl in the front row exclaimed.

Then, after reading more widely in the genre, they develop rubrics that represent varying degrees of accomplishment in that genre. One class generated the following rubric for memoirs:

**To Meet Standard: Memoirs**

- Have an interesting beginning -- introduce setting, characters, or situation
- Have details connected to main story parts (character, setting, heart, etc.)
- Events moving through time -- using pacing (say a little about some parts, a lot about others, like the "heart")

Along the way, students are encouraged to write "seed ideas" and "try-its" in their notebooks. They eventually pick one to develop into a draft that receives feedback, is revised, and is eventually published and celebrated.

Teachers learned about these aspects of writing and writing instruction in summer workshops, in the Saturday Speakers series, in visits to the classrooms of exemplary teachers, and in their work with coaches. While the components of writing instruction in ECRW are much more articulated and tightly aligned than in SVMI, there is still considerable variation in how these ideas take form and shape in teachers' practice, an issue we will begin to explore in following parts of this report. In general, participants learned a new language for explaining their teaching practice. They learned new strategies for teaching writing – mini lessons, conferencing, and the like; they learned to listen to students and diagnose what kinds of support students need. They became familiar with new curriculum materials – both those developed by the ECRW staff and others that are more widely available to teachers across the U.S.

As is the case in SVMI, these ideas are more-or-less familiar to some ECRW participants. Gail, a third grade teacher who we have worked with closely, explained that, prior to the introduction of ECRW,

*a lot of the writing we did involved reports. Every year a student wrote a report and we had basic elements: table of contents, glossary, bibliography, depending. We did a lot of writing that way. In 3rd grade, we were always responsible for conventions, okay. So making sure that students edited their work. But ECRW is about developing craft. The actual craft of writing that we didn't do as much of. We talked about elements and as you went up through the grades . . . we talked about voice, we talked about ideas, and organization, the traits of writing. But now, with this program, we're doing a lot with the actual craft.*

Another teacher, Lynn, had read Lucy Calkins's work before joining up with ECRW; she also had prior experience with teaching writing using a workshop format through her involvement with the New Standards project at her site. Because of her prior experience with New Standards, the surface features of her classroom practices may not have changed as dramatically as some of the other teachers involved in ECRW. Lynn explained that her experiences with New Standards convinced her that "kids could really do a lot more than we had asked them to do before." What ECRW added was what she called "bigger thinking and more than just writing. The fact that the kids
would, in the process of thinking about their writing, . . . [get] smarter about other things. Be more thoughtful.” She said that, although some concepts she introduces in her mini lessons do not actually make it into the student writing right away, students “are starting to come up to me and show it to me . . . in their reading . . . And the more they recognize it in their reading, I think, the more they’ll be able to apply it to their own work.” The good news, according to Lynn, was that, “in talking to the teachers who teach 5th and 6th grade . . . the thing they reassure us of is that the hard work that we’re doing . . . in primary grades is paying off later.”

Kathleen, a fourth/fifth grade teacher made a similar observation about the intersection of student reading and writing when she discussed the author study she taught:

It’s really very thorough and it touches on a lot of different things. I like the way the reading and the writing is so . . . I mean, of course, that’s inherent in responding to literature genre. But it just has a good feel to the room. The reading and the writing is so combined. I like that there is, you know, a small sort of grammar part of it and they talk about vivid verbs and so they’re able to not just concentrate on the aspects of the book and story, but they’re also looking at the words and they’re decoding and they’re guess wording and doing all these other things that really help them with their reading as well as their writing.

In sum, in both ECRW and SVMI, teacher-participants tend to talk about their teaching in new ways, which reflected their gradual reconceptualization of what teaching and learning looks like. For some teachers, their classroom practices also changed: They asked students to talk more, they asked students more questions, teachers and students alike engaged in – and got excited about – writing or solving mathematical problems in innovative and nonpredictable ways.

And, as we would expect from previous research on education reform, teachers varied in the degree of or fidelity of their implementation. In fact, as we have briefly noted, ECRW staff developed an implementation scale – the \textit{WWIS} -- on which they could locate each teacher-participant as high, medium, and low implementers of the writing process “package.” SVMI did not develop an implementation scale; indeed, what it meant to “implement” the ideas of SVMI was much less clear to us at the study’s onset, for there seemed to be much more room for combining different elements – problems, assessments, classroom discourse, instructional representations – in a variety of patterns. Nonetheless, during the course of this research, SVMI staff developed an observation guide – the SVMI \textit{Mathematics Teaching Rubric} -- that was then used (at times) by coaches to evaluate teaching and to guide their discussions with SVMI participants.\footnote{This rubric is available at \url{www.noycefdn.org/math/resources.html}. The \textit{WWIS} is available at \url{www.noycefdn.org/literacy/resources.html}.}

Important to note is that both programs conceptualized teacher learning on a continuum (Feiman-Nemser, 2001), and teachers were not expected to pick up the ideas of these programs and import them wholesale into their classrooms immediately upon encountering them in a summer institute. Reforming teaching looks much more like tinkering here, with teacher gradually adding new strategies, ideas, and materials into their existing practice.

\textbf{Subject Matter Knowledge (Including Understanding the “What” and “How” of Writing and Mathematics)}

A second shift appeared to be in how the teachers thought about or understood the subject matter – in this case, writing or mathematics. Both programs gave teachers significant opportunities to do mathematics and to write, to study writing and to pose...
over the writing of particular authors. SVMI teachers do mathematics problems in 
Math Network meetings, they solve the performance assessments that students will be 
asked to take and discuss multiple solution paths, they work alone and -- more often --
in groups to solve mathematical problems in the summer institutes. ECRW teachers 
write in the summer institutes as a means for "getting inside" of the "writerly life."
They carefully scrutinize different genres and various authors. Consider a snapshot 
from one summer ECRW Advanced Institute:

Nearly 100 elementary school teachers from schools in the region have gathered at a 
local elementary school for the second day of a five-day professional development institute. 
On this second day, teachers gather by grade level in separate classrooms. In the third grade 
meeting, 20 teachers work together with three literacy coaches to generate a list of common 
attributes of memoir. When they have completed their list on a chart at the front of the 
room, the coaches ask the teachers to continue their exploration of the genre by trying to 
categorize the books piled in the center of each table. Very soon, the teachers have additional 
lists of questions – is this a memoir? It doesn’t have its significance stated clearly at the end. 
Another teacher notices the way one of the books begins. These conversations reflect 
authentic discourse within the field of English studies, conversations that are of critical 
importance to writers engaged in producing work in particular genres. And these 
discussions of the larger structures of memoir lead quite naturally to a discussion of 
particular craft moves these authors make – how one reveals character through narrative 
description and other uses dialogue.

Engaging in this particular activity, teachers played multiple roles. On one level, the 
practice of “immersion,” an important aspect of the writer’s workshop, was modeled. As 
teachers themselves were being immersed, they were also expected to learn some steps they 
could use to immerse their own students in the study and activity of writing. A cyclical 
assumption underlies the structure of the teachers’ opportunity to learn here. As they 
themselves are immersed – with an eye toward learning how to teach writing—the teachers 
are also learning about content, in this case, about genres. As they examined several 
different examples of memoir, teachers identified and defined the rhetorical structures that 
characterize the genre and discussed how those rhetorical structures contribute to the impact 
of the memoirs they read. Engaging in those conversations, teachers participated in one of 
the central debates in the field of English studies—that is, the interaction between form, 
function and content—and they came to see that memoir is more than a simple check list of 
three or four features. While this particular vignette is about memoir, the same kinds of 
conversations occurred with other genres such as informational texts and persuasion (in the 
upper elementary grades).

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Maggie, a 3rd grade mathematics teacher from Summittville, California, enjoys “sneaking” 
over to a particular table during her monthly professional development meetings. She likes 
this table because it is where the “real mathematicians” sit. Maggie likes these people 
because they have a certain rhythmic vigor. They talk about math like her family talks about 
politics -- responding to others’ ideas spontaneously and energetically, never missing a beat. 
They often go out on a limb, are not afraid to make mistakes, and are not afraid to go so far 
as to change the problem. “They are full of ‘what if’s?’ ” as Maggie likes to explain. They 
constantly tweak a problem, make it more interesting, give it a new twist. Maggie leaves 
these sessions full of wonder and excitement, charged with new ideas for her classroom, and 
with a revitalized interest in and enthusiasm for mathematics.

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One central practice of many of contemporary professional development programs 
is what we will here call “disciplinary engagement,” by which we mean opportunities for 
teachers to act as writers or mathematicians, scientists or historians (e.g., the National 

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Writing Project, the California Subject Matter Projects, and the Laboratory Science Teacher Professional Development Project). Indeed, central to the creed of the National Writing Project is the belief that teachers who write are the best teachers of writing. And in both ECRW and SVMI, it was common practice to have teachers engage with the subjects they teach. Shulman (2005) argues that every profession has its signature pedagogies—characteristic ways of teaching and learning that professionals use to socialize new members into the field. Disciplinary engagement seems to have become one such signature pedagogy for much contemporary teacher professional development.

But what do teachers learn from “doing” the subject matter? Both programs presume that they acquire enhanced content knowledge of mathematics and writing. In our analyses of the data, it appeared that “disciplinary engagement” (Duffy, Fiori, & Wilson, under review), appears to have multiple potential payoffs. We describe five potential benefits here, all of which are related to gains in teachers’ content knowledge:

⇒ Developing teachers’ own writing and mathematical practices
⇒ Developing cognitive empathy
⇒ Increasing subject matter knowledge
⇒ Developing an appetite for future content learning
⇒ Developing a broader conception of the discipline, different than what is commonly represented in school

We now consider each of these.

**Developing Teachers’ Own Writing and Mathematics Practices**

One line of thinking about teaching, albeit an idealistic one, highlights the centrality of teachers as stewards of the disciplines. From this perspective, teachers are conceptualized as intellectual role models, both in terms of what they know, as well as their enthusiasms for learning new things, and for engaging in discipline-based inquiry into important problems. In this sense, they identify with others in their disciplines.

But teachers -- especially elementary school teachers -- are not known for their deep ties and affiliations with the disciplines. Indeed, few have adequate opportunities for deep study of the disciplines to develop such affinities. In fact, elementary and secondary teachers’ knowledge of disciplines has been shown to be suspect in research in mathematics (e.g., Ball, 1990; Ma, 1999), science (e.g. McDermott, 1990; Hewson-Tabachnick, Zeichner, & Lemberger, 1999), and history (e.g., Wilson & Wineburg, 1988). In particular, they have little experience with Schwab’s (1978) syntactical structures, the norms for generating, validating, and disputing new knowledge. This lack of teachers’ experience in disciplinary engagement could be tied to deficiencies in higher education, especially in the sciences in which many scholars suggest that it is not until well into one’s doctoral studies that a student is inducted into how knowledge is produced by scientists.

The experiences offered by SVMI and ECRW are intentionally designed to run counter to this tradition, and immerse teachers in the practices of writing and mathematics. In ECRW, teachers are introduced to the work of writers and writing through the summer Induction Institute. They engage in focused study of writing by keeping their own writers’ notebooks and selecting a piece of their writing to take from draft through considerable, repeated revisions, to “publication.” Survey and anecdotal evidence suggests that ECRW teachers write more often, and with more confidence and enjoyment than before participating in the program (see Table 5.1).

Our observational and interview data confirm these patterns. One of the teachers -- also a coach in the initiative -- explicitly discussed how becoming a writer herself was
one of the most powerful learning experiences she had in ECRW. As part of her participation in professional development activities, Claire had decided to take on -- with some seriousness -- the process of polishing a children’s book that described the experiences of her daughter’s travels to a foreign country. “I am trying to be a writer myself, to try what the kids do and publish pieces. And I realize now that it’s hard.” Claire took her book through all of the stages of drafting that ECRW lays out: she found a topic she cared about, looked for examples of texts that might help her envision what she could do (ECRW calls these “mentor texts”), wrote drafts, sought feedback, revised, and polished the book as a final piece. In addition to seeing herself as a writer, others came to see Claire as a writer — teachers at her school often sought her advice on writing and even a parent who was working on a children’s book sought her feedback.

Another ECRW coach reported that she felt more like a writer than she ever had — and that some parents at her school saw her that way as well. In the books talks she helped to organize at her school, she recalled reading a book:

_We had a book talk on What You Know by Heart by Katie Wood Ray and that was a lot about why it’s important to be, to try all these things ourselves with our writing so that we can learn from it and teach kids through our own writing experiences. So you’re not just showing models of Cynthia Rilant but you’re saying, “Okay, I gave this a try and here’s what I have.” And [that] made me realize I need to do a lot more of my own writing. And I do quite a bit of writing, but it isn’t a story about my life or anything. It’s like writing for my job. It’s writing letters to my family. My daughter lives very far away and I handwrite her a letter every week. And I’m thinking that’d be a perfect place I could start trying to really write well, try to craft something rather than just dashing off a quick list of what we’ve been up to. So that’s one of my goals._

In SVMI, teachers are also given opportunities to engage in mathematical practices. Maggie, the third grade mathematics teacher described previously, came to SVMI with a desire to participate more fully in the discipline of mathematics. While Maggie is modest — to the point of being overly deferential to teachers and coaches she feels are more expert than she — she knew that the best way to become more mathematical was to jump in and participate. This explains her persistence in sitting at what she described as “the good table,” with folks she thought of as the “real mathematicians” during professional development sessions, and her insistence on asking mathematical questions when working with her coach. The fact that she has begun to think of herself as a “budding mathematician” was regularly evident in her classroom. In one lesson, after Maggie had attended a series of professional development sessions on probability, her newfound enthusiasm was palpable. She told her students that the ideas they were about to work on were going to “blow them away” and “defy their predictions.” The students found Maggie’s passion exciting, as they sat up straighter and stared at their energetic teacher. Their engagement was clear as they participated in a series of well-designed probability experiments.

Throughout this lesson and others, Maggie presumed that students would experience a desire similar to her own — for plunging into mathematical ideas — if she could communicate them with enthusiasm and mathematical integrity. During another class, when Maggie ambitiously tried to connect the concept of fractions to that of tessellations, the results were mixed. On one hand, by using shapes the students were very comfortable with in previous tessellation activities, Maggie avoided common misconceptions about the core meaning of fractions. On the flip side, she made the connection between tessellations and fractions too strongly, failing to indicate to the students that some “fraction shapes” are not “tessellation shapes.” Nonetheless, the class was productive. Maggie listened carefully to students’ ideas, asking them tough questions: “Can you connect your beautiful design to fractions that have 6 in the denominator?” “Can you point in your picture to the parts of the fraction? and the
whole?" She was consistently encouraging: “That’s very insightful. Do you want to explain how the two ideas are connected?”

Maggie’s was not the only case in which we found evidence that teachers in both programs not only engaged in the practices of writing and mathematics more often, but brought that engagement into their practice. Our observations of classroom instruction indicated that teachers wanted to share their experiences engaging with writing and math content to the students. In ECRW, teachers often referred to students as writers - greeting them at the beginning of a mini lesson: “Good morning writers.” Or, when talking about a particular strategy employed by professional writers, one teacher noted: “We’re writers, so we’ll try to do this too.” Among SVMI participants, there was also a language that emphasized that the participating teachers and their students were engaged in mathematics. In SVMI, participants -- whether talking among themselves at a professional development session or working with their students in a class -- used the language of “thinking mathematically” or “engaging in” and “doing” mathematics.

Developing Cognitive Empathy

Working with problems always helps me with my teaching because it puts me in the student role and helps me explain and design better lessons. – SVMI teacher

A second potential benefit of disciplinary engagement is the development of cognitive empathy on the part of teachers towards the students. An important part of a teacher’s work is seeing where a student is in her struggles, so that the student can be appropriately helped or encouraged (Black & Wiliam, 1998). And it may be that when teachers have recently struggled with their own mathematics problems or writing projects, they are more attuned to and aware of the challenges their students face. Even when the teacher’s own disciplinary work is more advanced than that of her students, important parallels can often be drawn. For example, a teacher working on a sophisticated geometry problem might go through a similar pattern of misconceptions, frustrations, and novel ideas as a second grader struggling to figure out a number pattern.

Most of the case study teachers specifically cited aspects of cognitive empathy as a beneficial outcome of their professional development experiences. In post-lesson observations, Maggie often spoke in detail about her students’ mathematical thinking, commenting empathically: “I’ve been where he is.” Lynn, an ECRW teacher with over 25 years of teaching experience confessed that initially, she was not too keen on engaging in activities that she might do in her own classroom. In describing the summer institute, she said:

We had that business of being asked to do what you’re asking your kids to do and we had to write during that week and I remember thinking: “I don’t want to do this. . . . I don’t want to go home at night and have to write little memories.” That was very annoying to me. But in fact, it was valuable because I could look back on that when kids were doing similar things with notebooking or whatever and be able to talk with them from the standpoint of “Yeah, I know exactly what you’re experiencing and this is what happened to me.” So I realize that there’s

28 We do not mean to imply that every time a teacher takes any idea from professional development and directly imports it into his or her teaching that good teaching is the result. Indeed, there were times when this kind of direct importation seemed either off the mark or premature (given the teacher’s own emergent understanding). The point we wish to make here, however, is that teachers consistently searched for and found connections between disciplinary engagement and the kind of experiences they wanted to offer students in their own classrooms.
value in it but it . . . doesn’t stop me from getting that initial reaction, which is: “I don’t want to do this kind of thing.”

Lynn’s reaction is not uncommon when teachers are asked to participate in activities designed for children; that is, she found it “annoying” when she was asked to play the role of learner. However, her comments suggest -- and our observations confirmed -- that although she was initially reluctant to participate, it became a valuable resource that she drew on when teaching. We should point out here that on most occasions in SVMI and ECRW, teachers were not asked to role play elementary or secondary students. Instead, they were asked to become adult students, to learn mathematics while solving problems, and to learn what they thought through writing. In so doing, the SVMI and ECRW staff were asking them to come to what Dewey (1902) might have called a feature of the “psychological” aspects of a discipline -- understanding the human experiences associated with coming to know, as well as mastering the “logical” or organized, and efficient products of that discipline.

Increasing Content Knowledge

Few would argue with the claim that teachers need to be knowledgeable about the subjects they teach; Schwab (1978) argued that this kind of knowledge was “substantive” -- the concepts and facts of a field -- and that it complemented the more dynamic syntactical knowledge we described above.

As previously mentioned, however, what kind of content knowledge provides teachers with the traction they need for their own pedagogical thinking is largely unclear. Some teacher education critics suggest that improving teacher content knowledge means that teachers should simply take more college classes in the discipline they teach. But other critics suggest that the type of disciplinary knowledge represented by college majors does not always align with what teachers need know to help support learning in K-12 settings. According to this line of argument, teachers have to have considerable content knowledge, but it is content knowledge for teaching (Ball & Bass, 2000; Ball, Hill, & Bass, 2005; Hill & Ball, 2004).

SVMI and ECRW respond to these critiques. Both programs are committed to increasing the specific content knowledge that participating teachers need. ECRW teachers learn about particular authors, genres, craft moves. They learn how professional writers write (something ECRW calls “living the writerly life”). SVMI teachers learn about mathematical representations, ways of modeling algebra, and strategies for solving geometry problems.

There was evidence that teachers had increased opportunities to learn about the content of mathematics and writing. In ECRW, participants were asked to rethink writing. Rather than seeing “writing” as a school subject -- like most elementary school teachers are taught to do -- that involves conventions and grammar, teachers were asked to consider issues of voice and the intentional use of rhetorical structures and forms of argument. ECRW activities helped teachers learn to unpack more precisely what “voice” means or, for example, what text structures they might teach students who are writing informational pieces vs. those they might teach students who are writing narratives. Doing so, of course, required that teachers sharpen their own knowledge about how texts work in a variety of genres.

We found evidence of teacher learning in participants’ discussions of memoir in one summer’s Advanced Institute. After scoring third grade narratives, coaches took teachers deeper into their study of narrative by immersing teachers in memoir. Teachers first generated a list of attributes they thought characterized memoir and then “immersed” themselves in several different examples of the genre. Teachers came to the meeting with a check-list-like understanding of what the genre is: memoir needs to have
four things in the following order: an introduction to an event, a detailed description of
an event, and its significance stated at the end.

What they realized after exploring “real” memoirs was that memoir is easily
described with such a checklist. So, for example, the teachers we sat with the Advanced
Institute initially thought that significance of an event needed to be stated at the end of
a piece. This was reflected in their students’ writing: all of the student papers had the
significance of the recounted events stated like a moral to the story at the end of ever
paper. Yet after they examined adult memoirs, they realized that writers don’t write
that way. As a result their expectations for the student writing changed.

In the process, teachers not only gained a deeper appreciation for the importance of
immersion in a genre as a teaching practice; they also gained a deeper understanding of
memoir as a genre. Their initial description of memoir was a list that included: “written
in the first person, all about the author, reflection/significance, events that actually
happened.” However, after reading and discussing concrete examples of memoirs,
teachers came across books that did not fit their initial list of attributes. For example,
one book was not written in the first person, another did not include the significance of
the events at the end of the story. In the process, teachers added to the chart and
developed additional charts that addressed craft elements, complicating their initial
understanding of the genre.29 By the end of the day, the walls were covered with charts
that reflected the genre’s complexity. Although engaging in these activities may have
impacted their pedagogical practice, unpacking different examples also allowed teachers
to acquire more knowledge of memoir.

Other evidence that teachers were acquiring new content knowledge through
ECRW included shifts in the teachers’ language. Seldom did we hear teachers use
terms like “text structure,” “craft,” and “voice” in the early stages of their involvement in
ECRW, say at the tables they sat at during their first summer institute or in their
discussions with students in classrooms. But those terms became part of their
professional language over time, appearing regularly in interviews, as well as classroom
observations, professional development sessions, and meetings with their coaches and
other ECRW staff.

SVMI participants also have many opportunities to increase their subject matter
knowledge. Maggie left her professional development sessions reeling with excitement
about the new mathematics she had learned. After a session on probability, she told us
about a fundamental shift in her mathematical understanding, and that she was
particularly fascinated by the idea that the theoretical results often defy our intuitive
predictions. Consider the oft-cited example that, given a room full of thirty people there
is a ~71% probability that at least two people have the same birthday. “This blew me
away!” she exclaimed. Not only was she personally excited about this, but she almost
immediately thought of a way to use her new knowledge in her teaching. In one class
we observed, as the students ran empirical experiments, they learned to anticipate being
“surprised” as they compared their theories with their empirical findings. Specifically,
she helped them understand that in most real life scenarios we are only given partial
information, from which we draw probabilistic conclusions. As more information is
given, we make our probabilistic guesses more accurate, and are often surprised by our
initial misperceptions. The students reacted with mathematical questions and
enthusiasm: “But we still don’t know what’s in the bag! What if we’re still wrong?
How much information do we need to be sure?”

This was not an exception in Maggie’s case. Early in the study, she explained to us
that the nomenclature of geometric shapes had always confounded her. Yet after a few

29 Coburn (2001) also found that when teachers participated in collective scoring of
student assessments, there tended to be more authentic, “deep” engagement on the part
of teachers.
SVMI sessions focused on geometry – where she could listen to other teachers and ask questions herself, Maggie began to display a strengthened awareness of how and why geometric shapes are named. Her notions of mathematical vocabulary evolved; before she saw it as something handed down and arbitrary; afterwards, she realized that the creation of mathematical vocabulary was purposeful and based on mathematicians’ needs.

For example, the following quadrilateral came up in her class:

![Quadrilateral](image)

Maggie noted that previously, this would just be a quadrilateral to her, as it was not one of the official “special” quadrilaterals (square, rectangle, parallelogram, etc.). But in the context of this class, she saw that it was useful for her to distinguish it as being a special quadrilateral in its own right — one that is made from four isosceles right triangles -- which affords it special properties.

In a lesson soon after the professional development session that led to this increased understanding, Maggie began her geometry unit by asking her students to brainstorm all of the “geometric” words they knew. She wrote them on the board: shape, triangle, circle, square, sphere, oval, rectangle, hexagon, cube, blob, clover, heart, star, number, shape, moon, crescent. She created a mammoth list, which was later shortened and refined and which included some clever vocabulary invented by the students. Maggie later explained to us that this type of open-ended brainstorming has been critical for her attending to her many English language learning (ELL) students. Her invigorated understanding of mathematical vocabulary helped her teach geometry in a new, potentially empowering way.

Jerry Heath, another SVMI participant, was also optimistic about how his SVMI experiences helped him improve his mathematical content knowledge. During professional development sessions, Jerry was active and engaged, often visibly excited about trying to wrap his head around new mathematical ideas. In one session about the properties of geometric shapes, Jerry shared an epiphany that he had about the concept of “convexity” of a polygon and how it relates to a proof of the sum of exterior angles theorem. Jerry was excited about his new understanding and subsequently shared it with his class with this statement and picture:

![Convex and Not Convex](image)

*The line connecting two points in a convex shape stays inside the shape.*

Jerry told us later that this definition helped him understand the heuristic of the proof of the external angles theorem. This is an example of where Jerry’s ideas about geometric properties seemed to be making an important shift, from a conception that saw geometric properties as a set of unrelated attributes, to a conception where the properties are related by a set of logical implications. Like Maggie, he immediately thought of ways that his increased content knowledge would be relevant to his teaching.

*Teacher Learning from Professional Development*
The case study teachers we observed provided evidence that they learned a great deal more about mathematics and writing through their participation in SVMI and ECRW. All reported that, as they acquired more subject matter knowledge, their confidence increased. Further, this increase in their understanding and confidence helped them know how to assist students as they struggled and helped the teachers learn how to present more educationally powerful and mathematically appropriate representations.

Teachers were also sensitive to the potential benefits of their increased content knowledge for their students. Amy Marrelli, a fourth/fifth grade teacher explained: “When a teacher is confused about what the elements are and how to teach them, so are the kids. And when the teacher is very clear, then... the teaching becomes that much more clear. And I found, especially with informational writing, when I was reading it, I thought, ‘I don’t know. I’m not sure what the controlling idea is. I’m not sure I know, and my kids didn’t know.’” Motivated by her desire to help students learn, Amy then began listening for information -- across the professional development opportunities she encountered -- that would deepen her content knowledge so that she could be a more thoughtful guide for her students.

Jerry also saw a direct link between his increased content knowledge and his teaching. He repeatedly mentioned that learning mathematics in SVMI was critical in transforming him from a traditional “plug and chug” teacher, to a “student-focused” teacher. Improved content knowledge helped him in what he thought of as his most “helpless” moments -- times when his students were bursting with energy and ideas, but he could not react to their ideas fast enough given his own lack of mathematical knowledge. In talking about this predicament, Jerry articulated a common dilemma for teachers: seeing multiple opportunities for student learning fly by at a speed too fast to react to. And it was not generic pedagogical knowledge about how to manage discussions that Jerry needed. Instead, the case study teachers -- like Jerry -- found that it was content knowledge and pedagogical content knowledge that enhanced their pedagogical flexibility and muscle. Jerry concluded that he wanted even more: “I get easily flustered. I wish I had a textbook for this kind of stuff. It would be very helpful.”

**Developing an Appetite for Future Content Learning**

Developing the habits of mind as lifetime learners is an important -- and often cited -- goal for professional development. One goal of both ECRW and SVMI involved building both the infrastructure and capacity for leadership within participating schools and districts so that when external program funding disappeared, the program effects would continue. Thus, one important aim for both SVMI and ECRW was to help teachers learn how to continue their engagement in writing and mathematics on their own, or in collaboration with their colleagues at their school or district. An additional benefit, the logic went, is that teachers who are themselves lifelong learners serve as models for students.

When asked about their desire for further professional development, nearly 90% of the ECRW survey respondents in both years of the survey administration reported a desire for more knowledge about the teaching of writing (see Table 5.2). Taken in isolation, one might be tempted to conclude that these data suggest a need for more content in ECRW’s professional development activities. However, when viewed with other survey, interview, and observational data, the response appears to confirm a commonly-held assumption that the more we know, the more we realize there is to learn. Certainly, ECRW participants report that their reading habits have changed: over 70% in both years agreed or strongly agreed with the statement “I read more children’s literature”; and over 75% in both years agreed or strongly agreed with the statement “I read more professional literature” (see Table 5.2).
Our observations confirm ECRW participants’ self-reports that they were developing an appetite for and commitment to their continued learning of content. Gail, for example, was painfully aware of her own limited knowledge of writing at the end of one lesson we observed. She approached the observer with a grimace and sigh; she almost seemed to go slack-kneed, admitting to some discouragement: “I think they’re getting it, but I need more examples from writing. As I learn more about writing and gather more examples, it’ll get better.” And we watched her — throughout her ECRW experience — search for and consume such knowledge, hopeful that her practice would improve as she deepened her own understanding of the craft of writing and about how to teach it to students. She was not alone. Many teachers, reminded in their classrooms that their will to implement ECRW was stronger than their capacity to do so at the moment, sought out their coaches and grilled presenters for more information to help them get closer to their goal of teaching writing to their students in the “Noyce way.”

Likewise, many SVMI participants told us that the program helped them become lifelong learners of mathematics. When asked about their desire for professional development that would strengthen their own abilities as problem-solvers and mathematical thinkers, survey respondents reported a similar increase in appetite for learning mathematics. Over 93% and 94% in the 2003 and 2004 administrations of the survey (respectively) agreed or strongly agreed with the statement “I want to learn more about mathematics and the teaching of mathematics” (see Table 5.4).

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>No Opinion</th>
</tr>
</thead>
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<tr>
<td>46.9</td>
<td>48.0</td>
<td>57.9</td>
<td>48.0</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Table 5.4. SVMI Participants’ Appetite for Continued Professional Development

Of course, it is unclear that those teachers with newly whetted appetites will continue to search out such opportunities to learn. Some will, of course, most likely those with insatiable appetites for professional development, who spend their summer breaks in workshops and summer sessions that they search out and often pay for on their own. For example, Maggie, an enthusiastic learner poised to jump at every opportunity, depends on institutions outside of her school for her learning. She cites four locales for her content learning: the people she works with at the monthly professional development meetings, a teacher from a summer workshop, her coach, and some coursework at a local state university. This year, however, her district has given her spot in SVMI to a new teacher, even though Maggie (while enthusiastic) is far from an accomplished mathematics teacher. However, in Maggie’s case it seems likely that she will seek out other opportunities for mathematical engagement and learning.

For other, less entrepreneurial, teachers, like Jerry or Lani, acting upon their newly kindled appetite for content knowledge can seem appealing but daunting. Jerry’s district recently lost SVMI funding and his coach had to stop working with him. Jerry is optimistic about — albeit intimidated by — the prospect of continuing on his own: “I think it’s going to be a process. It’s going to take more effort on my part, because there is still stuff from [SVMI] that I haven’t read, like books and the mathematics and the different things, I still need to read so I can come up with activities, and it’s not like it’s just there.” Lani’s district has a dedicated coach, but only gives teachers professional development days to work with the coach for two years. Lani remarks, “You just have to find the time, and I still do plan with her on my days off or after school.”
Developing a Broader Conception of the Discipline

School subjects often take on a mechanistic or algorithmic character: they become decontextualized and rule-governed enterprises. Consider the ever-present “five paragraph essay” or the similarly rigidly conceptualized and decontextualized “scientific method.” One final benefit of “doing” mathematics or writing was that some participants came to a new understanding of the subject matter they taught more generally.

The case study teachers told us explicitly that ECRW altered their understanding of what it means to write. Gail explained that a lot of the writing she and her students did before ECRW involved “reports… Every year a student wrote a report and we had basic elements: table of contents, glossary, bibliography, depending… We did, we did a lot of writing that way.” Amy, another case study teacher, said: “I don’t think I actually ever taught writing. I think I gave lots of writing assignments but I don’t think I actually ever taught students to write.” For these teachers and others, ECRW complicated the ways in which these they viewed what it means to “write” and what it means to teach writing. Writing was more than assigning writing, looking for elements of a report, or correcting grammar and spelling. Instead, writing begins with reading, specifically reading like a writer. Stephen King (2000) has argued that “reading is the creative center of a writer’s life” (p. 147). And one of the important features of the writer’s workshop is immersing student writers in a genre by reading widely within the genre.

So, for example, students in ECRW classrooms might learn about writing memoir by reading Thundercake or Thank you, Mr. Faulkner by Patricia Polacco (1990, 1998), Knots on a Counting Rope by Bill Martin, Jr. and John Archambault (1997), When I Was Little by Jamie Lee Curtis (1993), House on Mango Street by Sandra Cisneros (1991), Letting Swift River Go by Jane Yolen (1992) or Sitti’s Secrets by Naomi Shihab Nye (1994). Each text uses a different structure to accomplish its effects on readers. Studying those same books, one might then focus on smaller craft issues like using sensory details, using dialogue to develop characters, sharpening the focus, and different kinds of sentences that accomplish different goals. But reading texts with the intention of understanding their structures and craft is a different sort of reading activity than is typical in elementary school classrooms. In elementary school, students typically read to learn how to read or in the later elementary grades, they read for information. The kind of reading encouraged by ECRW -- where participants unpack the attributes of a genre -- was an activity we observed on many occasions in professional development sessions, whether teachers listed attributes of a genre from a text that was read aloud or engaged in longer discussions about the genre as a result of opportunities to pour over multiple examples from the genre. It was also something that we observed in the classrooms we visited.

This sort of reading had multiple effects on the teachers. First, by reading broadly within a genre, the teachers themselves came to know a wider landscape of text structures and craft moves. Teachers consistently told us that they found these experiences valuable, for they allowed them to understand a stronger curricular connection between reading and writing (which are all too often, unfortunately, conducted during separate hours in elementary classrooms). In so doing, the participating teachers came to reinvent their understanding of what writing was, and how it was connected to reading.

Likewise, SVMI presented teachers with a different, broader conception of mathematics. Traditionally, mathematics is presented by teachers and/or experienced by students as a fixed set of knowledge; the teacher’s job is to distribute this knowledge as efficiently and fairly as possible. In contrast, SVMI embraces a humanistic philosophy of mathematics, one that assumes that mathematical knowledge is only
meaningful with respect to the humans that create and discuss the ideas (e.g., Hersh, 1997).

For example, Lani learned from working with her coach that engaging in mathematics involves inventing strategies, not just employing them. Her coach encouraged her to help her first and second grade students create their own methods for addition and subtraction. In the classes we observed, instead of teaching the standard method for solving a subtraction problem, Lani first posed a subtraction problem and asked for ideas. Students developed strategies, Lani offered some of her own, and soon these strategies were named by the class so that they might be referred to throughout the year. Among the strategies were “Powerful P” (a method that temporarily ignores the one’s digit of the bottom number in a two-digit subtraction), “Elegant (or Excellent) 11” (a method which considers the one’s columns and ten’s columns separately), and more standard algorithms such as “borrowing.” By inviting her students to invent methods as well as employ traditional ones, Lani emphasized that problems can be solved with a variety of methods and that it is the mathematician’s job to find a good method (she was careful to teach her students that all mathematical methods are not created equally). Together, the student methods and the methods Lani introduced provided students with a larger array of approaches to pick and choose from.

Lani’s coach also helped her think of new ways to contextualize mathematics. She shared with Lani an elaborate story about a person selling cookies, within which a teacher can embed much of the second grade subtraction curriculum. Lani then embedded many of the subtraction problems she taught to her students into that story context, and it became a story that the children found fun and comforting. While not all math benefits from being contextualized in real world contexts, the computational topics of first and second grade mathematics helped Lani and her students interact with subtraction in a more concrete and meaningful way.

Our examination of what teachers learn from professional development revealed myriad potential lessons to be learned from an engagement in “doing” a discipline. Although we did not collect systematic evidence around these various effects on teachers’ understanding, we did see evidence that teachers can change their knowledge of the practice of writing or doing mathematics, acquire new content knowledge, develop cognitive empathy for students as they learn the subject matters, deepen their commitments to continued disciplinary learning, and change teachers’ conceptions of the subject matters more generally.

We end this section with a caveat. Although the self report data and our interview data suggest that teachers believe that their content knowledge grows as a result of participation in these programs, our own observations of the professional development sessions as well as classroom observations makes us circumspect about making claims about teachers’ learning of content. Learning content is hard work for the learners – in this case, teachers. Learning to write is hard, as is working one’s way through a challenging mathematical problem. For many SVMI and ECRW participants, a first step involves breaking down teachers’ misconceptions. Many first year participants tended to not think of themselves as capable writers or mathematical thinkers. Just getting them to “unlearn” these perspectives was challenging work for the professional development leaders. One important step in learning is to believe that you can.

But learning math or learning to write takes more than a positive sense of self, and it takes time. There were many opportunities offered to participants and many participants embraced them wholeheartedly. But what participants learned about writing or mathematics is harder to tell. That is, we were painfully aware that élan and interest are different than, although perhaps related to, increased content understanding. The participants certainly began to grasp critical, rather abstract notions, for example, that mathematics requires using models or that writing is a process. But the concrete details of those lessons came harder: which mathematical
models to use, and how to build a repertoire over time of appropriate representational tools, or how to teach a mini-lesson and when to conference with students, for example, takes time. Much of that detail/technical work of learning how to put these abstract ideas into action took place in teachers’ classrooms, away from the careful eyes of the Foundation directors and coaches.

Furthermore, even during professional development sessions that took place away from the press of classrooms, there were concerns about time. The curriculum clock ticks as loudly for professional developers as it does for classroom teachers. When everyone is so concerned about time – too much for teachers to learn, too much material to cover, too much to know (theoretical ideas, technical details, practical strategies, genres, mathematical concepts, the list was endless in both programs) – moments in classrooms and in professional development events that seem ripe with the potential for ‘digging into’ the mathematics or the writing get passed over, truncated, not taken up.

In our observations of the summer mathematics workshops, for instance, teachers were constantly involved in doing mathematics problems. Most of the time, most of the teachers were on task, and many produced solutions that would then get posted on a wall to be visited or observed by other participants in a walk around the room, or reported back to the whole group. But we never once witnessed during those sessions a professional development leader note a mathematical error, or discuss a solution that was less correct or more problematic than others offered. Thus, we saw respect and high energy, enthusiasm and engagement, but we did not see what it would mean for the teachers themselves to reveal what they did not understand and work on deepening their understanding. Nor did we see the public display of a development of deeper mathematical knowledge by confronting errors.

But why would we? Teachers are professionals who expect and deserve to be treated as such. Directly and explicitly acknowledging that they have not mastered the subject matters they teach can have fatal consequences for the trust and élan necessary for long term, intensive professional development. This is not a new revelation: We knew that coming into this study (Wilson & Berne, 1999). And we have bumped up against it repeatedly as we have attempted alternative means for assessing what teacher-participants actually know about the subject matters these programs intend to teach them in survey and interview items. For example, when we attempted to add content knowledge items on to the surveys for both ECRW and SVMI, teachers in our pilot testing made sly comments about “the Noyce way,” suggesting that they “knew” what the “right answer” should be – to modeling a mathematical problem or responding to a piece of student writing – and that they could answer with the right “Noyce answer.” But this did not help us track what they themselves were learning in terms of content knowledge or pedagogical content knowledge. Furthermore, when we added several open-ended items related to their knowledge to the surveys, most teachers skipped them. (They did not skip other open-ended items that asked for their insights into policy or school-related issues.)

Thus, we ran into both methodological and program problems when trying to document teachers’ content knowledge and pedagogical content knowledge. We say none of this in an attempt to take away from the considerable accomplishments of these programs. However, our observations have convinced us that teachers in these programs have quite uneven levels of subject matter knowledge; this theme will appear across the cases in the following section. The need for assessing what teachers know about their subjects is great, but developing and using those assessments is a methodologically and interpersonally complex affair.

**Understanding Teaching as Professional Work with Attendant Obligations**

A third major change in participants involved how they understand the profession and work of teaching – not just classroom practice, as we discussed in our first point, but teaching as work. Wood and Lieberman (2000) report a similar phenomenon with
the National Writing Project, as did the AIR (2006) who report that 95% of teachers say that participating in a CSMP had an influence on their career, and 51% reported that that influence was “major.”

Both ECRW and SVMI enable a kind of “upward mobility” for teachers, often – unlike participation in experiences like the National Board for Professional Teaching Standards – a mobility that did not require leaving the classroom and taking on administrative roles. There are multiple leadership opportunities for teachers: as coaches (formal and informal), as workshop leaders, as leaders of scoring sessions, and the like. Some teachers became well known for being exemplary or “good.” Visits to classrooms and discussions after visitations allowed teacher-participants to experience teaching as intellectual and public work. By that we mean, teaching required problem setting and solving, collecting evidence, reflecting on what happened, gathering resources to inform the work. And discussions.

One proxy for a shift in how teachers conceptualized the working of teaching involved how they spent their time outside of class. When we asked SVMI survey respondents how many hours they devoted to various professional activities during the year, teachers reported spending at least 1-14 hours a year observing other teachers, watching videotapes of teaching, meeting with other teachers, and/or reading professional literature (see Table 5.5). About 30% of respondents in both 2003 and 2004 reported that they spent more than 35 hours a year meeting with groups of teachers to talk about math teaching. This is quite a different portrait of schooling than that of the isolated teacher working within an “egg-crate” mentality or “parallel piecework” of schools (e.g., Johnson, 1990; Little, 1982; Lortie, 1975; Sarason, 1996).

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<thead>
<tr>
<th></th>
<th>None</th>
<th>1-14 Hours</th>
<th>15-24 Hours</th>
<th>25-35 Hours</th>
<th>More than 35 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observing other teachers teaching mathematics either in classrooms or on videotapes</td>
<td>13.2</td>
<td>18.1</td>
<td>72.4</td>
<td>6.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Meeting with a group of teachers to study/discuss issues related to the teaching of mathematics on a regular basis at your school or in your district</td>
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<td>10.4</td>
<td>43.4</td>
<td>33.3</td>
<td>17.1</td>
</tr>
<tr>
<td>Reading professional literature related to mathematics or the teaching of mathematics</td>
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<td>8.2</td>
<td>56.6</td>
<td>56.7</td>
<td>15.8</td>
</tr>
<tr>
<td>Supervising a student teacher/working with uncredentialed teachers</td>
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<td>72.3</td>
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<td>8.5</td>
<td>2.9</td>
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<td>Working towards certification from the National Board for Professional Teaching Standards (NBPTS)</td>
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<td>96.6</td>
<td>1.4</td>
<td>1.1</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Table 5.5. SVMI Participants’ Self-Reports Concerning Time Spent in Various Professional Activities
We found similar results with the ECRW teachers. Teachers observed one another, met in study groups, and read professional literature (see Table 5.6):  

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<tr>
<td>1-14 Hours</td>
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<tr>
<td>15-24 Hours</td>
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<td>Meeting with an group of teachers to study the teaching of writing</td>
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<td>30.7</td>
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<td>24.3</td>
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<td>29.1</td>
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<td>Serving as a mentor and/or coach</td>
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<td>71.8</td>
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<td>5.8</td>
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<td>7.5</td>
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<td>Attending a national or state teacher association meeting</td>
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<td>3.1</td>
<td>1.9</td>
<td>1.3</td>
<td>2.6</td>
<td>3.1</td>
<td>0.6</td>
<td></td>
<td></td>
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<td>Working towards NBPTS certification</td>
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<td>0.0</td>
<td>0.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.4</td>
<td>1.3</td>
<td></td>
<td></td>
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<tr>
<td>Reading professional literature</td>
<td>0.4</td>
<td>4.0</td>
<td>31.0</td>
<td>29.3</td>
<td>26.2</td>
<td>25.6</td>
<td>15.1</td>
<td>12.8</td>
<td>29.4</td>
<td>28.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 5.6. ECRW Participants’ Self-Reports Concerning Time Spent in Various Professional Activities**  

But these changes appeared to be more than increased activity or discussion. Just as teachers’ ideas about mathematics and writing were changing, so too were their ideas about one’s obligations as a teacher. Visits from others to their classrooms require teachers to articulate their practice – what they are doing and why. The very fact that teaching was made much more public appeared to breed a sense of professionalism that led to other behaviors as well. Teachers in both programs, for instance, report relatively high rates of professional reading. A number are participating in activities to prepare for National Board for Professional Teaching Standards certification. In both programs, they are active participants in professional organizations and networks (including the SVMI and ECRW networks sponsored by the Foundation).  

Further, participants were overwhelming positive about school, teaching, and their students. There is less “blaming the students,” and since the pressure has been taken off to “pretend” that one was an expert teacher who makes no mistakes, teachers seemed more willing to talk about their struggles without that feeling that they are admitting to being “bad” teachers. They seemed to enjoy talking about their practice and their learning. The case study teachers always eagerly invited us into their classrooms, and took time out of their busy lives to talk with us before and after. They invited critical feedback about the instruction we watched (which we did our best to withhold in order to be as unobtrusive as possible), not warm praise. At network meetings, Saturday workshops, exemplary teacher visits, the breaks between events are typically filled with talk of teaching – new books, new methods, students’ struggles, new lessons learned. When given the chance to interact informally, many teachers were not talking about the last movie they saw or a new restaurant. They spoke of practice: things that went well and didn’t, ideas they picked up in other places, new resources that they had found helpful. The internal evaluators for ECRW documented a similar shift:
Many teachers and principals talked about the professional tenor of their school changing as a result of participating in ECRW. The most prevalent comment was how the nature of the talk at the school had changed and become more professionally focused. Teachers noted that this part year discussions about students and their work, about teaching strategies and lessons tried, and about the direction of the school predominated lunchroom talk. One second grade demonstration teacher attributes this to the focus and collaboration that have been encouraged by the program: “It has given us a focus. . . . We really have something we want to talk about. Not just gossipy stuff.” (Bachhetti & Faigenbaum, 2001, p. 17)

Ideally of course, and by design in the programs, this enhanced professional demeanor is intended to be a permanent change. That is, the Noyce Foundation hoped that these programs would create permanent change in both teachers’ capacities to teach and in the cultures of the schools and school districts. But as rumors flew every year about Noyce cutting back on funding, at the same time that school districts felt the economic crunch of reduced state investment in public education, participants also spoke about their concerns that the time they spent learning – whether it was collaborating on curriculum design, or participating in lesson study, or collecting and analyzing student data, or participating in a meaningful conversation about their students and their teaching with a coach -- would get squeezed out. Sometimes teachers talk of “not being able to go back again” (e.g., Wilson, with Miller & Yerkes, 1993). While teachers were not going to unlearn the mathematics and instructional strategies they had learned, it was less clear that the changes in what they did as teachers outside of their classrooms were going to be as permanent as those changes that we witnessed inside of classrooms.

Inside Classrooms: How Principled Ideas of Practice Take Form in Schools, or What Learning Looks Like When You Go to School

While we witnessed significant shifts in teachers’ desire to acquire more content knowledge, their articulation of their practice, and their views of their work as teachers, those changes still beg the question: But are things different for students? Traditionally, this has not been a question that weighed on the minds of professional development programs. If teachers left Saturday workshops happy (usually because they had been allowed to “make-and-take” materials for their classrooms), professional developers were content to presume that classroom practice would improve. But it has been increasingly clear that teachers and policymakers alike are dissatisfied with traditional forms of “in-service training.” Instead of prepackaged presentations by outside experts, educators and policymakers are beginning to understand the need to design professional development that is long term, tailored to the needs of a particular school and district, and focused on students and content (e.g., D. K. Cohen & Hill, 2000).

Indeed, as we noted in the introduction to this report, a new mantra concerning the “best practices” of professional development has emerged. A core feature of this new image of professional learning is the need to situate teacher learning in schools and classrooms; another is to design opportunities for teachers to work out new practices in their classrooms and have time outside of teaching to critically reflect on those experiences. Thus, professional development leaders and staff are asked to take more responsibility for helping teachers use the ideas they encounter in professional development in their classrooms, actively supporting teachers as they alter their instructional practices. This movement to school requires new practices of professional development — the use of records of teachers’ practice (including samples of student work and videotapes of teachers and their students) (Ball & Cohen, 1999), time to try out materials in classrooms followed by time to inquire into what happened during those trials, coaching and co-planning or co-teaching — and they require professional development staff to take on new roles. The move also requires the development of new “tools” like the WWIS, the Mathematics Teaching Rubric, or the Tools for Teachers — all of which support professional development staff both in terms of “seeing” the reforms in classrooms and working with teachers to reflect on and learn from those experiences. For instance, as previously noted, it was the ECRW coaches who originally asked for
the *WWIS*, or some kind of support for helping them notice things when they visited classrooms. Later on, Poppers began using that tool for other purposes as well, for instance, for evaluating the relationship between the degree of a teacher’s implementation of ECRW ideas and processes and his/her students’ achievement.

Going to school is an eye-opening, humbling, overwhelming experience for professional development staff, coaches, and researchers. Not surprisingly, there is considerable variation in what one sees when one visits teachers’ classrooms. Before discussing the factors that appear to shape when and under what conditions teachers’ classroom behavior changes — so that things might be different for students — we describe several of the case study teachers and how they interacted with and responded to various messages — from SVMI, ECRW, and other sources — in their classrooms.

Lani Gibbs: SVMI. Lani Gibbs teaches a mixed first/second grade class in a progressive elementary school. The school is serious about teacher learning, is an active participant in a host of SVMI/MAC-related activities, and has unique professional development opportunities. For example, everyone in the school participates in “lesson study” groups each year, and has — at one time or another — received coaching from Jane Handley, the resident math coach. Lani claims that both of these opportunities — but lesson study in particular — have helped her encourage student thinking in the classroom. She says she has learned a variety of teacher moves that help her talk less and support students more as they try problems in their own intuitive ways.

Ms. Gibbs’s elementary school is located in a reasonably affluent area, and has excellent resources for the students and teachers. Although the property the school sits on is not huge, the school is designed like a campus, with different buildings and walkways between them. The student population is ethnically diverse, but most students are not ELL and hence converse with Lani quite fluently. The school has a high API rank (9 out of 10 when compared to all schools).

Lani’s efforts to talk less and encourage her students to talk more were apparent on a particular May 2003 morning in her classroom. She was taking advantage of a split period, where her class divided into two groups and each group took turns going to P.E. During this time, Lani had the luxury of meeting with a very small group (10 students) for half an hour each. They were working on two-digit addition and subtraction problems. Instead of working from an algorithm, however, Lani had them working on the problems with individualized “mental math” strategies, encouraging them to split up the numbers in inventive ways to perform the sums and differences.

“What's more important than the right answer?” Lani asked. “To show our thinking,” a boy responded. The students seemed aware of Ms. Gibbs’s demands on them to show evidence of their thinking. They methodically wrote out each small step as they broke up addition and subtraction problems. When they answered questions aloud, they seemed to almost instinctively give an explanation of how they got there.

The students first worked alone, and then shared their answers with the class later. As they worked alone, Ms. Gibbs guided them and offered suggestions. The level of autonomy she entrusted upon the students appeared to vary. While she was always excited to hear a student present an idea to her, she often guided them rather forcefully towards a method she preferred. For example, she seemed to favor methods that are more time-efficient. She stopped two students who were drawing pictures to represent the difference they were working on and said, “I’d rather you write equations because [drawing pictures] takes a long time.” She then fixated for a while on getting students to solve the problem using equations and asked a few other students, “Can you do it with an equation? Can you write an equation?”
Lani also consistently advocated some very specific tools for conceiving of sums and differences. For example, many of the worksheets she used contain the following box:

```
  22
  8  14
```

Students were to conceive of the whole as being in the top part of the box, and the two smaller parts in the bottom part of the box. For example, the following completed box could represent a variety of sums and differences, $22 - 8 = 14$, $22 - 14 = 8$, $14 + 8 = 22$, etc.

```
  22
  8  14
```

For many of the students, however, this box was not a model that worked for them. They knew that they were supposed to fill in the box to please their teacher, but often filled it in incorrectly. For example, for $22 - 8 = 14$, many students wrote:

```
  22
  22  8
```

Lani focused on their later work, in actually solving the problem, so she often did not notice the students’ misinterpretations of her model. When the students actually computed the sums and differences, they kept careful track of their work. For example, for $22 - 14$, a student wrote the following equations:

```
10 + 4 = 14
22 - 10 = 12
12 - 4 = 8
```

This meant that the student thought of 14 as 10 and 4, and first subtracted away the 10, and then the 4. The students, when asked to explain, were almost always able to describe how their set of equations corresponded to how they thought about the problem. Students used various expressions to refer to certain techniques for dealing with the problem. The method above is referred to as “Powerful P.” This name came from the following picture, where the circled quantity is in the shape of a “P”:

```
  22
  14
```

The circled part, or the “P,” means that you temporarily ignore the 4, subtracting the 10 away from 22, and then subtract the 4 from what is left. Another strategy, “Elegant 11,” refers to the circles below, which look like an ‘11’:

```
  22
  12
```
This means that the student is to subtract the ones places and the tens places separately, much like in the standard algorithm for a problem that does not require borrowing.

At first it seemed that the students in Ms. Gibbs’s class had developed their own addition and subtraction algorithms, and coined the phrases Powerful P and Elegant 11 to refer to different techniques. This would be a great example of a teacher supporting student thinking and strategizing, so much so that they together developed their own formal language of arithmetic (like Deborah Ball’s well-known “Shea numbers” named after Shea, the student in her class who proposed them). Lani told the observer afterwards in an interview, however, that she was the one who introduced many of these strategies to the students. In fact, Elegant 11 and Powerful P are her terms, ones she uses year after year. Nonetheless, many students seemed to understand these strategies, and may be “reinventing” some of the ideas behind them as they carry out the various moves.

After the students worked alone, Lani announced that it is time to share their work on poster boards with the whole class. She wrote on the poster board as the students shared solutions. She told us later that she does the writing (as opposed to the students) in order to save class time, thus allowing for more students to present their solutions. After each solution was shared, Lani asked if other students solved the problem in a similar way. If students raised their hands, Lani wrote their name on the poster board. Later she referred to this as “signing” the work, which she hoped gave students and sense of pride and ownership over the solution. She does the signing herself, as well, to save time. Such choices may save time, but may also run the risk of reducing the empowering effect of students presenting their work. The students seemed a bit bored during the sharing, some did not even seem to notice that she was writing their names on the boards. Also, in the frenzy of negotiating whose name should be signed on which poster board, Lani did not always put student names in the appropriate places. Maybe because the students were not highly engaged at the time, they did not question whether or not their solutions should be associated with the solution their name was being signed.

Like many of her SVMI colleagues, Lani is both committed to and increasingly more successful in encouraging student thinking than is typically supported by traditional mathematics classrooms and curricula. The Noyce experience has also helped Lani expand her curriculum repertoire. Because of its Noyce relationship the entire district has adopted the TERC (2004) *Investigations* curriculum. Lani attributes many of the worksheets and activities she used to both *Investigations* and to her coach’s help during lesson planning. This has required Lani, she says, to introduce an entirely new language into her classroom, one that embraces student thinking, representation, convincing, and in general puts the students in charge of their own learning.

In conversations with Lani, she often reflected on where she learned important lessons. For her, participating in a lesson study group dramatically changed the way she runs the classroom. According to her, she talks less and demands more from students. She has tougher requirements for student explanations, wanting the students to think about whether other students understand what they are saying. There is some evidence from observations that the students are aware of Lani’s requirements (students tell each other to show their thinking and ask for clarification from each other). Lani also told us that her professional development experiences have made her aware of more types of teacher moves that elicit student thinking. However, she struggled with wanting to get through curriculum and having no time for the kind of reflective thinking she thought was best for the development of their understanding. It was not unusual for us to see Lani rushing students through a problem when time gets tight (which was almost always the case).
Lynn Westmiller and Gail Ralston: ECRW. Entering Lynn Westmiller’s classroom – which is in a portable behind the Simon Elementary School playground — one would be impressed with the rich array of resources at hand. The classroom is cluttered with tall bookcases stuffed with books and several smaller bookcases with shelves that are double-deep with children’s literature. On the teacher’s desk is in the back corner of the room, there are neatly organized piles of papers and two or three teacher’s editions of textbooks. At the front of the room is a whiteboard. Below the whiteboard, there are two small tables with a pencil sharpener, extra pencils, paper, a stapler, erasers. In the back of the room, there is a bank of four computers that are used infrequently. In the back corner of the room, near the door is a large trash can-shaped bin that holds jump ropes and balls for recess. The third-grader-sized desks are arranged in five groups of four. They form a “U” shape around an overhead in the center of the room that projects onto the whiteboard. From the number of books available in the room, it seems clear that Ms. Westmiller has been teaching — and collecting children’s literature — for many years. Thirty-two years to be exact — with a couple years off to raise her own children.

For the most part, the classroom runs smoothly. Students have their books stacked in neat piles on the corners of their desks, smaller books (including their writer’s notebooks) and pencil boxes are stored inside their desks and they easily access other materials around the room when necessary. Students are aware of the classroom routines: when and how to excuse themselves to use the restroom, how they transition from one activity to the next, how they are excused and how they return from recess, and how to request the teacher’s attention during writer’s workshop. And some students are assigned tasks, which were sometimes invisibly accomplished during our visits — so, for example, one student was responsible for turning the CD player on (typically Mozart or some other classical composer) during the writing period, turning it off just prior to the closure at the end of the workshop. At a given time, another student would change the sign on the whiteboard from “Ø Noise” to “Accountable Talk.” During the writing period of the workshop, Ms. Westmiller quietly confers with individual — and sometimes pairs of — students. Rather than raising their hands or lining up to talk with her while she is conferring with another student, the children all have paper cones that they place on top of their books when they need teacher assistance. They know she will get to them during their writing period when she can.

Under another set of windows on the right side of the room is a carpet where students meet for their writer’s workshop mini lessons and where they share their work at the end of the writing period, during “closings.” At one end of the carpet is an easel with chart paper and some markers; next to it sits Ms. Westmiller’s desk chair and two big plastic containers filled with touchstone books. During the mini lesson, students sit scattered on the carpet so that they can see the easel. During sharing time, students sit in a circle around the carpet’s perimeter. At the back of the carpet is a small bookcase and above the bookcase are the charts that Lynn refers to periodically in her teaching. One chart that remains on the wall throughout the year outlines the writing process. Other charts have been generated in collaboration with students and they vary, depending on the genre under study. Those charts outline the students’ “noticings” about a genre, the craft moves that authors use, longer explanations of some of those craft moves, standards for the genre and rubrics that students generate to help them articulate the requirements of the genre. For example, when they were working on memoir, one chart listed “5 ways writers reveal what a character is like”:
Charts like these were typical and reflected the conversations that students had when they discussed examples from the books and other students’ writing that they read with Ms. Westmiller.

In a different school district several miles north of Simon Elementary, Gail Ralston also teaches third grade. On the surface, the classrooms look much the same. Though there are fewer books stored in the classroom, there are several smaller bookcases full of books for students to choose from and the classroom is next to a resource room where additional books are readily available. As in Lynn’s classroom, there are posters and charts on the walls that the students and teacher have developed together titled “Thinking of ourselves as writers” and “How to use a notebook” or that list “noticings” or standards in a particular genre under study. And like Ms. Westmiller’s classroom, those noticings and standards vary throughout the year, depending on the genre under study. Less evident, however, are charts that help students unpack particular craft moves in a genre.

The third graders’ desks in Ms. Ralston’s room are also arranged in five groups of four. Unlike Ms. Westmiller’s students — who neatly stack their books on their desks — Ms. Ralston’s students’ reading and writing materials are stored by table group on a bookshelf in the back corner of the room. “Materials managers” for each table group are assigned the job of making sure students have the proper materials for their writer’s workshop time. Inside students’ desks are independent reading materials, small plastic boxes with pencils, erasers, crayons, and perhaps a comic book, a rogue action figure or a few Yu-Gi-Oh cards. Two meeting tables with three or four chairs around them line a wall near the classroom windows. Additional student materials and cubbies are arranged on a counter just below those same windows. Ms. Ralston’s desk is in the front corner of the room and, like Ms. Westmiller’s, is neatly piled with papers and books. In contrast to the fluorescent hue of the classroom lights, the soft light of a small desk lamp often illuminates her desk. The whiteboard at the front of the room has the agenda posted on it daily.

Just to the left of the whiteboard is an easel with a couple of books neatly placed next to it. Helping give the sense of a smooth-running classroom, everyone in the class has assigned jobs that rotate during the year: materials managers for each table group, a student responsible for checking off items on the daily agenda, and the student of the week who is responsible for setting up Ms. Ralston’s stool and other materials next to the easel just before the mini lesson in the writer’s workshop. Like Ms. Westmiller’s students, these third graders know the classroom routines: how they are called to the carpet for the mini lesson, how they are excused to write, how they line up for recess.

Both Gail and Lynn have participated in the same ECRW professional development opportunities. Both report that they have altered their teaching of writing to include a
writer’s workshop. Ms. Westmiller, however, had been experimenting with writer’s workshop as a result of having come across Lucy Calkins’s (2001) book, *The Art of Teaching Writing*, well before her involvement in ECRW. In fact, she had participated in some of the New Standards “study groups” in her district. According to Lynn, as part of her participation in those study groups, she tried using writer’s workshop in her classroom. As a result, she asked her students to reach higher expectations than she had required before learning about the New Standards project. She admitted that she was skeptical at first, thinking that there was no way that students could reach the level New Standards required. And rather than using rubrics, she had developed checklists that some of her students found frustrating:

> I remember that that was very frustrating to some of my very good writers who felt as if they had already written a beautiful piece. Mom had said it was a good piece of writing, it was beautifully flowing, but it, you know, maybe [it was] a summary of a book instead of all the stuff that needed to be in there as well. So I remember having some talented writers, relatively, get very frustrated. Living through that and that was . . . hard, but finding out the kids really could do a lot more than we had asked them to do before [was good]. And they could really think a lot more deeply.

Lynn described her process of learning (in this case, writer’s workshop) as one in which she had to pull ideas together:

> I had done a little bit of Six Traits training and so it was sort of putting together this combination of what New Standards training I’d had and scoring and going through a lot of that stuff that they did several years ago with Six Traits and the readings on my workshop. Kind of putting that all together and just feeling like that was not only possible but pretty effective and, again, bigger, bigger thinking and more than just the writing. The fact that the kids, in the process of thinking about their writing . . . were also starting to be smarter about other things . . . to be more thoughtful. So that’s what sort of pushed me into doing it, seeing that there was value in doing this kind of a writing program.

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30 New Standards is a joint project of National Center on Education and the Economy (NCEE) and the Learning Research Development Center (LRDC) at the University of Pittsburgh. As explained on the National Center for Education and the Economy’s website: “Since 1991, New Standards has been a leader in the standards movement. It has developed and published a set of internationally benchmarked performance standards in English language arts, mathematics, science, and applied learning. New Standards has also pioneered performance-based assessments, developing the New Standards Reference Examinations and a portfolio system to help teachers build a standards-based curriculum. . . . Much of the standards and assessment development work was done in collaboration with more than 20 states, six large school districts and more than 600 teachers. States have used the standards to judge the quality of their own standards. As early literacy became a national priority in the 1990s, New Standards created pre K to grade 3 standards for reading and writing, speaking and listening, and English language learners as foundations for literacy success in the primary grades.” Sally Hampton, who played an important role in the creation of ECRW, came to the Noyce Foundation work directly from managing the English Language Arts program of the New Standards and many NCEE materials informed the early stages of ECRW’s development.

31 “Six Traits” refers to a rubric for identifying and evaluating six traits, or characteristics, of effective writing — ideas/content, organization, voice, word choice, sentence fluency, conventions — on a six point scale, with 6 the highest score and 1 the lowest.
Both Ms. Westmiller and Ms. Ralston participated in the ECRW summer induction institute the same year. However, perhaps as a result of her previous experience with New Standards and writer’s workshop, Ms. Westmiller was the teacher with whom her school’s coach collaborated as a “go-deep” teacher during the first year of implementation at her school. Ms. Ralston, on the other hand, was part of a team of six or seven teachers who initially implemented ECRW practices at their site on their own. During her first year, she said the most valuable parts of her training were the Saturday Speakers series (where she heard Katie Wood Ray and Carl Anderson) and the exemplary teacher visits. According to Ms. Ralston,

*One thing that’s valuable is to observe in the classroom. And so we went, the gal that I work with, we were both in the same grade level, so we went, as 3rd grade teachers to an elementary school . . . and that was very valuable because, you know, you can read and start to feel what the study will be about but then to actually see it in operation, see how the students relate to it, see an experienced teacher in the program and how it’s working for her, then to be able to look at the student work.*

*We had an opportunity to take student notebooks during our lunch break and also, we were able to look at their portfolios and to talk with the teacher and so she met with us and then we could ask questions and we could share our noticings and she could explain what was happening. It’s just very concrete and real when you can be right there, observing, and then kind of gave us, my teaching partner and myself, it gave us an opportunity, kind of a guideline of what it would look like in a real classroom. That was really good. And then I think with any program, you know, it’s putting together the pieces. We take it back and then we look at what we’re doing and we embellish our program and keep refining it.*

The summer following their first year of implementing ECRW, Ms. Westmiller attended the Advanced Institute. However, she reported being somewhat disappointed that the group had spent so much time scoring portfolios, which meant that they did not have much time to discuss what they noticed or what it meant for their instruction the following year. In contrast, Gail attended the induction with her colleagues. Although there is a good deal of investment in the summer institutes — both in terms of time, planning, and financial expense — neither teacher mentioned them as the most important aspect of their ECRW experience. When asked whether they planned to attend the Advanced Institute the following summer, neither one did. Gail said that they did their own scoring sessions at their schools, where the discussions included observations about instructional implications, which were much more satisfying than the more narrow focus on scoring.

Ms. Westmiller enjoyed a very close collegial relationship with the coach at her school; on several occasions during our observations, the coach — Mrs. K — stopped by for visits before or after school to discuss student writing, approaches to different genres, or reading selections for their adult book group at the school. Ms. Ralston did not have such a close relationship with her coach and saw the coach largely as a person who could provide resources — in the form of mini lessons or books for mini lessons. And we never saw the coach during any of our visits to the school. We should note here — and we will discuss this later in the report — that the majority of ECRW participants did not have coaches, or significant relationships with coaches. For instance, in the 2003 and 2004 surveys, somewhere between 9 and 40% of respondents reported working with a coach.

Our study began after both teachers had been through their second summer of professional development in ECRW, and so we observed both Ms. Westmiller and Ms. Ralston during their second and third years of implementing ECRW. Neither one had much formal coaching, except for informal conversations about materials, resources, and strategies. While Ms. Ralston did have a short cycle of coaching during the second year
of our observations, she did not enjoy the same sort of rapport with the school coach as the close ties Ms. Westmiller had with her coach. And while both teachers found coaching helpful, both also said their coaches were mostly busy with teachers who were new to the program. In addition to the professional development opportunities sponsored by the school and school district to assess writing achievement at their schools, both teachers participate in their respective school’s book study group where teachers, coaches, and sometimes the principal meet to discuss professional literature they read together.

The structure of the writer’s workshop in Ms. Westmiller’s and Ms. Ralston’s class was largely the same: students were called to the carpet at a given hour of the morning, they participated in a mini lesson of roughly 10 minutes in length, were excused from the carpet for a 40-minute writing period when students worked independently on their writing and the teacher conferred with individual students, and then returned to the carpet where students shared their work with one another (closing). Even though both teachers organized their language arts time in similar fashion — with mini lessons, a writing period and a sharing time and closure — there were striking differences between the two classrooms that are revealed most clearly in the way the teachers conferred with students during the writing time.

Ms. Westmiller is soft spoken, but firm in the classroom. Never once did we hear her raise her voice to a student. Instead, her reprimands often came through facial expressions (a raised eyebrow or direct eye contact) and later, perhaps, a private talk or a general announcement about a behavior she had noticed. Her conferences were typically with one, sometimes two students and generally began by asking about how things were going. One conference featured in this analysis occurred in the fall of 2003. The students were completing a genre study of memoir, a genre that all students in ECRW study at some point during the year.

On this day, students were in various stages of finishing their memoirs and Ms. Westmiller was having a conference with Derek. She sat next to him at his desk and asked him whether he had completed his checklist; he nodded that he had. She then asked him to read his paper aloud while she looked over his shoulder. When he finished the first paragraph, she reminded him that the other day they had worked on run-ons. She pointed to a sentence, asking him to read it again and tell her where the period goes. He read: “I could also see the white clouds they were as white as a polar bear.” She repeated the sentence aloud to him three times and, after the third time, he put a period after “clouds.” She explained to Derek that he needed to read and edit while attending to run-ons. She then asked about spelling words. She said she saw quite a few words that were not spelled correctly, and asked him to go through and circle each one he was not sure of. She said that some writers have suggested that if they read their work backwards, they often catch spelling errors. She explained that when we read it through quickly, our eyes often fill in the errors and this breaks up the flow just enough to help us pay attention to the words. She didn’t ask him to correct the errors, just to circle the ones he was not sure of.

Derek read his piece through and we watched him as Ms. Westmiller went on to another conference. He circled several words: angenst, scord, be (for “beat”), rinirores, tride, hurd, charging, dripling, field. He returned to Ms. Westmiller, who was finishing up with another student. “You’ve found the very ones I noticed!” she exclaimed. She looked the paper over and helped correct some of the words, but said (looking at the observer) that she did not know how to spell the plural for of rhinoceros. She asked Derek to get a dictionary and together they looked up the word. In doing so, she pointed to the root of the word, the definition, the plural form, the part of speech. She then returned to his paper, corrected a couple more words and asked him to check the rest as she moved on to another student.
Fast forward to another conference at the end of the school year during one of our last observations. Students were returning to their writer’s workshop routine after two weeks of standardized testing. They were completing drafts of their second exploration of memoir that year and were scheduled to have a publishing party in four days. The mini lesson that day focused students’ attention on the development of rubrics that they could use to measure their work against the standards they had been discussing and incorporated some of the “noticings” they had done about the craft moves that authors make in the genre. Before dismissing students from the mini lesson, Ms. Westmiller reminded them that when she conferred with them, she would be asking them what they were doing to make their writing better.

As students settled into their writing time, Ms. Westmiller circulated and stopped at Alex’s desk. She looked over his shoulder and he said something to her that was inaudible to the observer. She pointed out to him that, “You’re discovering what works for you as a writer. You’re taking one of your try-its and asking how it sounds.” He read to her from his notebook: “parked cars, silent and subtle . . . ” and explained that it was one of his try-its for something else, but it might work here. He tells her that he also wanted to describe the weather because it would show what kind of day it is, it creates a scene. Before she left, Ms. Westmiller said she thought he was beginning to see who he is as a writer, learning what works for him. He added that he was trying a “Lemony Snicket style” in which he will try to talk directly to his readers. She smiled and encouraged him to keep at it. Later when the students were at the carpet sharing what was working for them that day, Alex volunteered that he thought he was “finding out how I write.” He then explained to his classmates that he did a quick draft of something, then he did a series of “try-its” (craft moves that he was learning in mini lessons), and he would then circle back and combine some of those craft moves in the next revision of his draft.

ECRW coaches and professional developers often reminded teachers that they needed to “teach the writer, not the writing.” And indeed, it appears that this is what Ms. Westmiller attempted to do here. In the first example, she gave Derek some strategies that she says writers use to edit their work: reading backwards and using a dictionary. And she showed him some of the kinds of information that can be found in the dictionary. Rather than simply giving him the correct spelling (which she certainly does for some of the words), she took the opportunity to think out loud with Derek, apprenticing him into a way of thinking about editing his writing. In the second example, Alex was clearly learning to see himself as a writer. He used descriptive writing with intention (to “show what kind of day it is”). In addition to trying strategies that he sees professional writers use, Alex was also becoming aware of how he writes.

As a contrast, let us consider how writer’s workshop took shape in Gail Ralston’s class. A dark-haired woman in her 50s, Gail is also soft-spoken in the classrooms and expends a tremendous amount of energy during the writer’s workshop, in part, because her attention seems a bit scattered or diffused. One day in March 2003 was typical of our observations: students were gathered on the carpet for a mini lesson that focuses on descriptive writing — what has been called “show-not-tell” writing. They were in the early stages of gathering entries for their genre study on memoir and she told the observer that day that the students were beginning to focus on “different techniques we can use.” As she set up the overhead, Ms. Ralston reminded the students that yesterday they talked about “show-not-tell.” Today, she explained, she was going to show students a selection from a Tomie dePaola (2000) book, Here We All Are. She explained that yesterday, they read this piece focusing on the way in which dePaola grabbed our attention by asking a question: “Have you ever moved into a new house?” On this day, she wanted them to read on to see how dePaola grabs their attention and makes readers want to find out about his new experience. She read the selection, alternating her reading with commentary for students. She read the opening, starting from the beginning:
Have you ever moved into a new house? A whole house with a basement, a first floor, a second floor, and an attic? Well, when we moved from an apartment to our new house -- our very first house -- it was the greatest thing that ever happened to me. At least up until then.

She paused here to note for students that the fact that when the author claims, “It was the greatest thing that ever happened to me,” this is an indication that the genre is memoir, something life-changing, something monumental. She reminded students that they needed to ask whether the event they are writing about was life-changing. She then noted that the next part of the selection is “show-not-tell.” She read:

Here I was, standing in 26 Fairmount Avenue. I ran up the stairs and down, into the living room, the dining room, and all the bedrooms, all the way up to the attic and down to the basement. Then I ran up and down all over again. Everything in 26 Fairmount Avenue was new! Well -- almost everything.

She asked students what show-not-tell is. One student noted that it has repetition -- for emphasis. Gail then asked whether anyone saw the word “happy” or “excited” in the story. They answered in chorus,

“No!”
“Because what’s he doing?”
(In chorus) “Showing.”

Gail then explained that the writer is using actions to show how he feels and then asked her students:

“If in your work, you want to tell us about a time you were excited, what did you do? She points to a student, saying: “Take your mom and dad’s wedding. How did you feel?”
The student replies: “Nervous.”
“So, you might say ‘My stomach was all ______” (she pauses)
Student replies: “Butterflies.”

The conversation during the mini lesson proceeded in this fashion, with Ms. Ralston posing questions about the students’ work that they responded to in one-word answers. In closing the mini lesson, Gail continued:

These are some of the ways the writers show us, not tell us. At the level you’re in -- in third grade (because I’ve read those teacher books), you’re just learning to do this. Students are used to telling, and now, we’re pushing you ahead.

She explained to students that she wanted them all to try it today. She wanted them to find an entry in their notebooks that they can “show, rather than tell.” “Find an old entry,” she explained. “And be ready to share at the end of the work time.” She re-read the example of showing from the overhead, noting at the end that the author showed us he was excited and that he used only one adjective – “greatest.” Everything else is “showing.”

Ms. Ralston dismissed the students to begin writing, picked up her clipboard and approached a student, Naila, who was still flipping through her notebook, looking for a selection to rework. Ms. Ralston suggested that Naila work on an entry that described an anniversary party thrown in honor of her parent. She asked Naila to read the passage. After Naila admitted that the selection was “telling, not showing,” Ms. Ralston made several attempts to have the little girl describe the event in more detail. Naila pointed to a section where she was excited to watch a video during the celebration.
“How did you feel?” “What did the video make you feel like . . . what did you do . . . why do people have them?” Ms. Ralston prompted.

The conference was interrupted four different times, first by a student who had a question about what to write, one who needed help “thinking,” another with a question about spelling, a fourth who wanted to know if she could write about bats.

When Ms. Ralston returned her attention to Naila, the third grader had added to her notebook: “I enjoyed watching the recorded events.” Ms. Ralston praised Naila’s use of “nice language,” redirecting Naila’s attention to the gifts, “You wrote a lot about those. They made an impact.” She also suggested that Naila add something about this being a 10th anniversary party, flipping through the 3-page selection to try to identify a place where the student might add that detail.

Ms. Ralston then brought the dePaola selection over to Naila, asking her to read it aloud. Ms. Ralston noted that dePaola draws readers in with the question at the beginning.

“Remember how I said that I’d never moved into a home with multiple floors before? And that [his question] drew me in? Do you think you can use the idea of a question to draw attention to your piece? How can you pose a question to draw in readers?”

Naila responds: “Use details?”

Ms. Ralston asks: How can you state a question though? Have you __________ (she waits . . .) Have you ever __________(she waits . . .)

Naila responds: “Have you ever had a 10th anniversary?”
Ms. Ralston replies: “Okay, did YOU have the 10th anniversary?”
Naila revises: “Have your parents ever had a 10th anniversary?”

Ms. Ralston concluded the conference with several suggestions for additions that Naila might make “to make the party seem special” before moving on to a student who has been hovering around the table for a couple of minutes.

On the surface, Ms. Ralston has changed her teaching practices dramatically: she no longer focused her instruction just on conventions using worksheets and the occasional written “report.” Instead, she trained students’ attention on the “craft” of writing: to do so, she used mini lessons, an extended writing period, and time for sharing. However, closer examination revealed some challenges that Ms. Ralston faced. Rather than “teaching the writer,” apprenticing Naila into the discourse and practices of the discipline, Ms. Ralston pointed to specific sections in the piece, making several different suggestions for things Naila might add. By making those suggestions specific to this piece of writing – and not to the challenges that Naila faces as a writer — Ms. Ralston fell into what is a comfortable mode for teachers – she “corrected” the writing. Her questions — that read almost like a cloze test — (un)intentionally communicate the fact that there is a narrow range of right answers. Clearly, Ms. Ralston was practicing opening up the conversation to students, but in so doing, she made a classic mistake of asking leading questions. These surface changes are not surprising: as D. K. Cohen (1990) and others have pointed out, even the smallest changes in practice can feel revolutionary to a teacher.

Moreover, the interruptions make it difficult to follow the thread of the conference, giving the writing period an almost breathless quality. As she conferred with Naila, Gail was interrupted repeatedly by other students asking questions. On one level, the interruptions might be a relatively simple matter of classroom management. It is possible that Ms. Ralston only needs to add to the “routines” for her writer’s workshop.
In that case, she would merely teach students that when she is conferring with students, she is not to be interrupted and they are not to stand by waiting for her attention.

It is also possible that some challenges that Ms. Ralston’s case presents reveal a need for deeper content knowledge. At the end of this lesson, Ms. Ralston approached the observer with a grimace and sigh; she almost seemed to go slack-kneed, admitting to some discouragement: “I think they’re getting it, but I need more examples from writing and as I learn more about writing and gather more examples, it’ll get better.” Painfully aware of her own limited knowledge of writing and of how to teach writing, she hoped that her practice would improve as she learned more.

However, there may also be something more fundamental going on, something illustrated both in the kinds of questions that Ms. Ralston asks and in the students’ apparent reliance on her permission and approval. Her questions and the students’ dependence on her to get started could also reveal something fundamental about Ms. Ralston’s views of the teacher-student relationship. Whether she is aware of it or not, Gail positioned herself as the arbiter of what is acceptable or correct in the students’ writing, perhaps a carry-over from her years of teaching merely “conventions” using fill-in-the-blank worksheets. Indeed, even some of the questions she asked — during the mini lesson and during the conference — paralleled the fill-in-the-blank format. Asking questions in this way preserved her authority as the expert. All the craft knowledge in the world will not shake her practice if Ms. Ralston continues to feel obliged to be that authority.

Another factor that might influence Ms. Ralston’s interaction with these new practices is the way in which she views the nature of student learning and development. In our conversations, Ms. Ralston frequently referred to her students as third graders who are not “ready” for particular concepts. She even responded to some of their questions in class by explaining that “when you get to a higher level of language you can use that strategy, but in third grade, we’re not there yet.” Viewing her students in this way might not only limit what Gail sees students as capable of understanding, but might also shape her interactions with them as well, and what she can learn from ECRW experiences — within and outside of her classroom.

**Pi Day: SVMI.** Our last case focuses on a schoolwide event rather than on an individual teacher, and on ideas that were not introduced by SVMI but were nonetheless picked up by and used by SVMI participants. It takes place in a school that has integrated SVMI into its entire math department. There is a dedicated math coach who works with all the teachers and all of the teachers have attended MAC professional development sessions for at least one year. While what happened in the school that day is not an event endorsed by SVMI, the fact that it occurred in a school saturated with SVMI teachers will help us point to some core challenges faced by professional development programs that try to change school cultures and make schoolwide change. The ideas of ECRW and SVMI do not enter vacuums. Rather, they enter schools where other ideas – historical and contemporary – shape what teachers do. Understanding the interaction of such ideas is one part of helping reforms take root in schools. Pi Day is but one reminder of how complicated such work is.

In 1768, Johann Lambert proved that \( \pi \), the ratio between the diameter and the circumference of a circle, is an irrational number. This landmark mathematical breakthrough showed the world that the on-going 4000-year project of honing in on this number with careful approximations was, in fact, an endless frivolity. The real truth about the number is that we will never really know its value. That is the beauty of Lambert’s discovery.

Two hundred and thirty six years later, in Summitville, California, an entire middle school contemplated the value of \( \pi \). This occurred on what has been coined ‘Pi Day,’ a national event (in some circles) that utilizes one of the most mystical numbers to gather
excitement and interest in mathematics. In this school, Pi Day was a party, complete with food, music, games, and ubiquitous references to the digits of pi (such as the official date of ‘Pi Day’—March 14) and puns on its name.

During these festivities, students were asked to think about pi in two disparate ways. On one hand, the students attended to the number’s strict value. Reveling in pi’s string of essentially random digits, students were encouraged to recite these numbers and marvel at their infinitude. Pi digit-reciting contests were held in each classroom, and then the finalists took part in a championship round in front of the entire school during lunch. Some students appeared enraptured by this activity, and in the class we observed, they cheered loudly as the winning boy recited 66 digits of pi. During the championship round, the entire school fell silent in awe as the winning girl recited a whopping 200 digits of pi. When she finished, the crowd erupted into an enormous cheer — a mixture of sincere expressions of enthusiasm and some sarcastic whooping.

The other way pi was addressed could not be more different. When digits were not being recited, activities were no longer centered on pi’s characteristics as a number but rather related to pi in an imprecise, far-fetched, almost goofy manner. Many of these activities were centered around puns on the number’s name. Slices of apple “pie” were sold. Students were sent around to different doorways to figure out puzzles that played on the name pi, such as “cow pie” and “pie in the sky.” Students were then invited onto a stage in front of the whole school to read poems about pi, or to perform songs. The poems and songs played off of pi’s mystique and the infinitude of its digits. “My love for you is infinite,” started one poem read by an 8th grader. Later, a pi song and a pi rap alluded only vaguely to the concept of pi, but made many references to its name and its infinite representation. These performers were all rewarded with praise from the teachers and were each given an entire apple pie for their efforts. After the school-wide performances concluded, students returned to their individual classrooms and played “pi bingo.” The entries for the bingo game were the English spellings of the Greek letters (alpha, beta, etc.). By this point in the day, pi’s meaning has been reduced to that of a letter — no different than the other Greek letters used in the bingo game.

These two faces of pi are at opposite extremes, one about accuracy and technical value of the number, and the other about free-form word plays and associations on the number’s name. As different as they are, both are distinctly non-mathematical. Mathematicians think about ideas. Approximations of values are only considered if there is a physical or mathematical reason to consider them. In the case of an irrational number like pi, arguments that prove its irrationality, such as Lambert’s, are more important than endless attempts to enumerate the digits. If Lambert were alive today, he would probably have been confused about the digit recitation contest. Didn’t they understand the significance of his discovery? The day’s attention to the name “pi” was also strange, from a mathematical perspective. In mathematics, names given to objects are distinctly less interesting than the objects themselves, and merely facilitate the discussion of concepts. While puns and plays on words can be fun and clever as an aside to authentic mathematical forays, in this school they became a main focus of the day, marginalizing other discussions that would have been interesting and mathematical. The attention given to “pies” (as in the kind you eat) during Pi Day, could be compared to a Shakespeare festival that devoted much of its attention to “spears” (as in the kind you throw.) In mathematics, as with Shakespeare, there is some other content worth addressing.

There are a variety of directions Pi Day could have taken that would have addressed some of these more substantive issues without straying too far from the general spirit of the day. For example, consider long decimal approximations of pi. These very well may be part of the allure of pi, and a good way to help students think about the number. These approximations have a long history that features interesting, clever mathematical arguments. Approximations of pi date back to Babylonian times.
with crude physical measurements giving values of \( \pi \) between 3 and 3 1/8. Later, Greek thinkers used mathematical arguments to approximate \( \pi \) by inscribing and circumscribing measurable polygons in circles. Many of these arguments are within the grasp of middle school students, and, left to their own devices, students will come up with their own interesting ways of approximating the number. To arrive at approximations that extend to 200 digits (such as the approximation given by the champion girl of the recitation contest), modern infinite series approximations of \( \pi \) must be employed. While middle school students may not be ready to derive such results, they can play around with such series, and at least be given a taste of what kinds of (mathematical) tools are used to approximate a number such as \( \pi \). Discussions about why one might need a close approximation of \( \pi \) would also be valuable. How close an approximation would you need to build a circular component of a building? A bridge? How close an approximation would you need to show that an enclosure with a circular boundary has a greater area than a hexagon with the same length boundary? What on earth could require the use of a 200-digit approximation? At the end of day of exploring some of these techniques and reasons for approximating \( \pi \), a \( \pi \) digit recitation contest might have been a nice way to have some fun, especially if the previous activities highlighted how unmathematical that aspect of the day was.

Suppose, on the other hand, a \( \pi \) festival intended to play off of \( \pi \)’s mystery and charm. While the pie pun goes a certain distance in its humor and appeal, it does not quite encapsulate why cultures around the world have been fascinated with \( \pi \) for thousands of years. Instead, there is a long and interesting history of lore and enchantment with \( \pi \) that is worth sharing and discussing. Did the Babylonians at times use the crude approximation of 3 because that was the best they could do, or were they afraid about the spiritual implications of such a naturally occurring ratio having a non-whole number value? Could this be compared to the ridiculous legislation passed in the state of Indiana in 1897 that declared \( \pi \) to be rational (despite what the mathematicians said), declaring such a law to be a “contribution to education”? If the Greek mathematicians had known about \( \pi \)’s irrationality, would they have been fearful of this knowledge, as they were when they discovered the square root of 2 — the diagonal of a unit square — had this property? What about \( \pi \)’s tendency to show up in some of the most profound and unexpected places? Defined as the ratio of diameter and circumference, why does it also show up in the formula for the area of a circle? How could combinations of predictable sequences of rational numbers, such as the example below, ever equal \( \pi \)?

\[
4(1 - 1/3 + 1/5 - 1/7 + 1/9 - 1/11 + \ldots)
\]

These issues are fun and valuable to speculate upon in the classroom. They add to the allure of \( \pi \), while at the same time exploring the history and mathematics behind the number.

At the \( \pi \) festival at this school, and particularly in this 7th grade classroom, \( \pi \) was treated with mystique and allure, but not with mathematical substance. Rarely was the simple meaning of \( \pi \) mentioned — that it is defined merely as the ratio between a circle’s diameter and circumference. Its marvelous complexity is only interesting when compared to these simple origins. Instead, \( \pi \)’s infinite nature was often mentioned, but students do not seem sure what that meant. Frequently during the festival, such as during the poem about \( \pi \), students stated that \( \pi \) is infinite. Infinite in magnitude or infinite in representation? This is an important difference, and not one that the students distinguished between, nor did any teacher point it out. Again, Lambert would have been saddened to see his great discovery unrealized so many years later. In one class we observed, the teacher expressed the belief that when you compute the square root of two on a calculator, the calculator holds the exact value of the number in its memory. This raised questions for us about whether the teacher fully grasped what it means for a number to have an infinite representation. Granted, it is a difficult concept that a
number might be *uncomputable*, not one a seventh grade teacher or student is expected to fully master. In fact, mathematicians did not come up with a complete understanding of the irrational numbers until Richard Dedekind’s construction of the real numbers in 1858. Nonetheless, if a school is to have a *π* festival, where they revel in the mystery of an irrational number, then it would be terrific if they could use the celebration to tackle the exciting challenge of thinking about the mathematics, about what this means.

So what happens when a difficult mathematical concept is treated superficially? One outcome is that students might end up with misconceptions. They might not understand what *π* is, what it means that its representation is *infinite*, or why this is important. But that is just the beginning. There are other, worse outcomes. Students might learn that an acceptable response to difficult ideas — one that their teacher and school embraces — is to cover up substance with mystique, rote memorization, and puns. They might learn that the ability to recite digits of *π* represents mathematical intelligence. Indeed, when the champion girl recited 200 digits of *π*, we overheard one student say to her friend, “Wow, she is really smart. I could never do that.” Those two students might already have believed that mathematics is about rote memorization, and to be reminded of it on this occasion (and to have that misconception reinforced with the showcasing of feats of memorization) might affect their interest in the subject — either liking it or disliking it for this misrepresentative characteristic.

But maybe these dangers are worth it for how fun the day is. Maybe *Pi* Day is valuable solely for the enthusiasm about mathematics it generates. But, at the end of the day, is it the *math* that was fun? Or is it *Pi* Day — a day where mathematics is distinctly avoided — that was fun? And is it even that fun? It is difficult to tell exactly how much fun the students were having. They seemed happy about the change of pace, and they were certainly enjoying eating the (apple) pie. But there was a taste of dissatisfaction in the air, evident in the sarcastic tone to some of the cheering, and in the tired, clock-watching expressions on the students as they played their last round of *π* bingo. Maybe *Pi* Day can be improved upon. If *Pi* Day keeps the celebratory tone but had also taken some of the truly mathematical directions mentioned above, it could help the students become more excited about the math, not just about the party.

And, as we mentioned, Pi Day was not endorsed by SVMI. But teachers who were enthusiastic about SVMI were equally enthusiastic about this day. They did not see the connections between the lessons they were learning about rich mathematics in classrooms and the substance of Pi Day, nor were they troubled by the wasted time and opportunities. Perhaps that is to be expected: SVMI leaders had their hands full just trying to integrate MARS assessments, Singapore boxes, and Problems of the Day into teachers’ practice. Learning to be critical consumers of other mathematics activities — while it is something that all of the SVMI staff would hope for their participants — might be a goal that is somewhere further down the line.

Summary

The purpose of this research was to document and explain what teachers learn from participating in SVMI and ECRW. Thus far, we have summarized some general trends that we documented in both surveys and fieldwork. When one looks across teachers, there are many answers to the question: What are they learning? They learn about mathematics and writing, about writers’ workshop and Singapore boxes, they learn to take on new roles and responsibilities to use and to search out more and better resources.

But when one looks at individual teachers and what happens in their classrooms, the clarity with which one can say definitively that (or what) teachers have learned gets muddied. Individual teachers are on different trajectories of learning, those trajectories are shaped by what opportunities to learn they participated in, as well as other factors
including a school’s culture and history of reform, a district’s commitment to the reforms, a teacher’s history with the specific content and teaching strategies being explored and endorsed in these programs, and the developmental trajectory of the professional development program itself, for both SVMI and ECRW are “works-in-progress.” In the following sections, we describe how these factors may shape teacher learning in these two professional development programs.
Part 6:
What Opportunities for Learning Do Teachers Participate In?

The case study teachers we shadowed patched together combinations of professional development for themselves, based on what they were interested in, what their schools or school districts required, and what was readily available. The patchwork nature of their professional development experiences was more pronounced in SVMi than in ECRW, which is a much more structured program in some ways. But in each program, teacher-participants exercised their autonomy, which was — not surprisingly — a double-edged sword. Both programs believe in teachers-as-professionals, and as professionals, teachers should have the freedom to select their own self-improvement programs. But individual teachers were not always in a position to know what they did not know, and thus we saw some teachers — several of whom had histories as “professional development groupies” — showing more and more progress, lapping up all opportunities to learn, while other teachers remaining more circumspect in what they chose to participate in and/or take from the experiences they encountered in SVMi and ECRW. The differences in what opportunities they participated in are an important factor in what those teachers learned from SVMi and ECRW. Thus, as an initial step in understanding differences in what teachers learn in these programs, we considered their patterns of participation as they were reported on the surveys for 2003 and 2004.

ECRW

In ECRW, there are some activities that teachers report participating in frequently (see Table 6.1). Not surprisingly, these are activities that are very close to their classroom practice, including planning their own curriculum (67% in 2003 and 65% in 2004 reported doing this 8 times or more), experimenting with components of ECRW in their teaching (65% of survey respondents in both 2003 and 2004 reported doing this eight or more times), and having informal discussions with colleagues (65% in 2003 and 59% in 2004 reported participating in such discussions ten times or more). Other activities have lower frequency rates but, still, more than half of the survey respondents reported participating in at least 3 times a year: watching a coach or an exemplary teacher model instruction, participating in school-wide discussions of professional literature, grade level meetings to discussion writing instruction, and professional development about the teaching of writing held outside of school.

The least frequently used activities included visiting other classrooms in their home schools, attending the Saturday Speakers series, and working with a coach on student work.
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<td>24.2</td>
<td>34.2</td>
<td>27.8</td>
<td>13.7</td>
<td>13.8</td>
<td>5.6</td>
<td>7.3</td>
</tr>
<tr>
<td>Visiting classrooms in other schools</td>
<td>29.4</td>
<td>36.2</td>
<td>23.4</td>
<td>16.9</td>
<td>40.9</td>
<td>37.7</td>
<td>4.3</td>
<td>5.8</td>
<td>0.0</td>
<td>1.8</td>
</tr>
<tr>
<td>Visiting other classrooms in my school</td>
<td>37.9</td>
<td>51.2</td>
<td>37.4</td>
<td>25.8</td>
<td>16.2</td>
<td>16.3</td>
<td>3.4</td>
<td>2.8</td>
<td>3.0</td>
<td>3.1</td>
</tr>
<tr>
<td>ECRW Speaker Series</td>
<td>39.6</td>
<td>59.3</td>
<td>28.1</td>
<td>26.9</td>
<td>25.5</td>
<td>9.0</td>
<td>2.6</td>
<td>1.9</td>
<td>2.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Having a coach study my student’ work &amp; comment on how I could increase learning</td>
<td>38.1</td>
<td>35.3</td>
<td>28.4</td>
<td>29.8</td>
<td>16.5</td>
<td>20.4</td>
<td>9.3</td>
<td>7.3</td>
<td>6.8</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Table 6.1: Frequency of Participation in Various ECRW Opportunities to Learn

In sum, for many teachers, talking about or working on the teaching of writing appears to have become part of their daily practice – they report experimenting with strategies and materials in their classrooms, having discussions of relevant professional literature in their schools, and having informal conversations with other teachers. While their participation in other opportunities to learn is much less frequent, in the next section of this report we will see that it is the combination of daily, locally-situated activity with “special events” – summer institutes, working with coaches, observing other teachers – led to changes in teachers’ knowledge of writing, confidence as writers.
and teachers of writing, willingness to experiment with new materials and strategies in their classrooms, and appetite for future professional development.

About half of the teachers had a coach visit his or her classroom at least 3 times over the course of the year, another 27-28% had a visit from a coach 1-2 times a year; approximately 20% of the respondents reported never working with a coach. Given the centrality of coaching to both ECRW and SVMI, we also asked specific questions about respondents’ experiences with coaches (see Table 6.2). In particular, we were wary of the tendency in research on coaching (or mentoring) to presume that coaching is monolithic. Our observations of teachers and their coaches in ECRW and SVMI led us to believe that there was a range of both pedagogies and content in the coaching relationships.

And indeed, we found that survey respondents reported a wide array of activities that they did with their coaches. There were some things that teachers had done with coaches once or a few times, including co-planning a lesson (34 and 38% of respondents in 2003 and 2004 respectively did this a “few times” with their coaches), watching a coach model a lesson (33 and 35%), getting assistance from a coach in how to manage students or a classroom (29 and 27%). But other activities seemed more the bread and butter of the coaching relationships: coaches went in search of materials (44 and 50% of respondents report that they did this “a few times” with their coaches, and 28 and 23% reported that coaches did this monthly). Coaches also provided teachers with ideas for lessons (44 and 52% have coaches who do this “a few times,” 20 and 13% have coaches who do this monthly), met regularly with groups of teachers, not simply one-on-one with a teacher who has just been observed, and had frequent conversations with teachers about the writing content of a lesson (40 and 48% have done this with their coaches a few times; 24 and 19% monthly, and 12 and 9% at least weekly). Coaches appeared to spend the least amount of time helping teachers with management issues in their classrooms (49% in 2003 and 54% in 2004 reported never working on this with a coach) or in learning to work with other teachers.
Table 6.2.  

<table>
<thead>
<tr>
<th>Opportunity to Learn with Coaches</th>
<th>Never</th>
<th>Once</th>
<th>A few times</th>
<th>About monthly</th>
<th>At least weekly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed by a coach</td>
<td>20%</td>
<td>20.5</td>
<td>11.7</td>
<td>14.4</td>
<td>43</td>
</tr>
<tr>
<td>Co-plan a lesson</td>
<td>34.8</td>
<td>30.8</td>
<td>13.5</td>
<td>12.5</td>
<td>34.3</td>
</tr>
<tr>
<td>Coach conferences before/after a lesson with the teacher</td>
<td>25.3</td>
<td>29.6</td>
<td>12.0</td>
<td>13.7</td>
<td>42.9</td>
</tr>
<tr>
<td>Coach models a lesson</td>
<td>45</td>
<td>40.5</td>
<td>10.0</td>
<td>12.5</td>
<td>33.3</td>
</tr>
<tr>
<td>Coach helps with assessing student work</td>
<td>35.6</td>
<td>29.9</td>
<td>15.0</td>
<td>16.8</td>
<td>38.6</td>
</tr>
<tr>
<td>Coach assists with analyzing student thinking</td>
<td>41.7</td>
<td>39.6</td>
<td>10.9</td>
<td>12.9</td>
<td>33</td>
</tr>
<tr>
<td>Coach assists with managing the classroom/students</td>
<td>49.1</td>
<td>54.5</td>
<td>8.7</td>
<td>9.8</td>
<td>29.6</td>
</tr>
<tr>
<td>Coach assists with working with other teachers</td>
<td>45.2</td>
<td>46.0</td>
<td>9.6</td>
<td>11.0</td>
<td>31.7</td>
</tr>
<tr>
<td>Coach assists in locating materials and/or supporting the use of them</td>
<td>7.8</td>
<td>11.9</td>
<td>9.5</td>
<td>8.3</td>
<td>44.6</td>
</tr>
<tr>
<td>Coach provides ideas for lessons and activities</td>
<td>12.2</td>
<td>11.6</td>
<td>8.7</td>
<td>8.9</td>
<td>44.3</td>
</tr>
<tr>
<td>Coach discusses writing content</td>
<td>13.9</td>
<td>16.5</td>
<td>8.7</td>
<td>7.1</td>
<td>40.4</td>
</tr>
<tr>
<td>Coach meets with a group of teachers</td>
<td>7.3</td>
<td>7.0</td>
<td>5.2</td>
<td>5.5</td>
<td>36.1</td>
</tr>
</tbody>
</table>

Although ECRW teachers participated in a broad array of opportunities to learn, they had clear opinions about which of those were most helpful. For example, teachers reported that informal opportunities to discuss the teaching of writing with colleagues were the most helpful form of professional support (72% and 79% of respondents in 2003 and 2004 respectively judged these to be very helpful). Second to that were the ECRW materials, which 55% and 51% (from 2003 and 2004) judged to be very helpful. Teachers also reported that grade level and district level meetings were helpful.
Table 6.3  Participants’ Self Report on the Usefulness of Various ECRW Components

Fewer teachers reported finding the ECRW Speaker Series or the Induction or Advanced Institutes as helpful. The majority of teachers reported that those occasions were either somewhat or a great deal helpful. However, we should note that we used the language of the Noyce Foundation in the survey; since all teachers are required to participate in the “induction institute,” the fact that 43-44% reported that it was not applicable to them makes us wonder whether respondents thought that this referred to something else. The same may also be the case with the Advanced Institute, although fewer teachers do participate in those activities. (Although we should also note here that, in interviews, our case study teachers also said that they did not find the summer institute work as satisfying as work they did in their schools.)

SVMI

SVMI survey respondents demonstrated a similar interest in a broad array of activities (see Table 6.4). When asked to report on what they had participated in since 1998, respondents in 2003 and 2004 reported that many of them had participated in administering MARS assessments (over 65% in 2004), and many had also participated in scoring sessions for the MARS exams (over 62%). Forty seven percent had worked with a coach, while almost 30% had not had a coach. Over 40% had also participated in monthly professional development sessions, although we cannot be sure what those were.
I administered the MARS (MAC) exam to my class

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>0.0</td>
<td>5.1</td>
<td>3.9</td>
<td>8.2</td>
<td>15.6</td>
</tr>
<tr>
<td>2004</td>
<td>16.90%</td>
<td>9.2</td>
<td>24.7</td>
<td>15.3</td>
<td>44.2</td>
</tr>
<tr>
<td>I was a teacher working with a coach</td>
<td>0.0</td>
<td>5.1</td>
<td>3.9</td>
<td>8.2</td>
<td>15.6</td>
</tr>
<tr>
<td>I was a teacher working without a coach</td>
<td>31.2</td>
<td>20.4</td>
<td>39.0</td>
<td>21.4</td>
<td>42.9</td>
</tr>
<tr>
<td>I attended professional development sessions</td>
<td>7.8</td>
<td>3.1</td>
<td>18.2</td>
<td>7.1</td>
<td>33.8</td>
</tr>
<tr>
<td>I attended the summer lab school</td>
<td>1.3</td>
<td>2.0</td>
<td>5.2</td>
<td>4.1</td>
<td>11.7</td>
</tr>
<tr>
<td>I was a coach</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.3</td>
</tr>
<tr>
<td>I participated in scoring sessions</td>
<td>10.4</td>
<td>7.1</td>
<td>11.7</td>
<td>11.2</td>
<td>28.6</td>
</tr>
<tr>
<td>I participated in a lesson study</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
<td>0.0</td>
<td>6.5</td>
</tr>
<tr>
<td>I was a summer lab school leader</td>
<td>2.6</td>
<td>0.0</td>
<td>1.3</td>
<td>0.0</td>
<td>5.2</td>
</tr>
<tr>
<td>I had no involvement</td>
<td>23.4</td>
<td>32.7</td>
<td>16.9</td>
<td>25.5</td>
<td>11.7</td>
</tr>
</tbody>
</table>

Table 6.4. Survey Respondents’ Participation Patterns in SVMI Opportunities to Learn

There was a sudden increase among the respondents in participating in the summer coaching institute (13% had participated in 2002-03, nearly 40% in 2003-04). This may have been due to survey administration; as we mentioned earlier, there were considerable problems with selection bias for the SVMI survey given difficulties in negotiating when and where the survey would be administered. Also of note is that only a smattering of teachers had participated in other opportunities to learn (13% in lesson study at their schools, 5% at the lesson study institute, and 2% as a leader in a summer institute).

As in ECRW, we also asked specific questions about what kinds of activities teachers participated in with their coaches. And, like in ECRW, teachers and their coaches did a range of things together. Most often, coaches discussed mathematics content with the teachers (45% in 2003 and 24% in 2004 report doing this at least monthly with their coaches; 16% and almost 9% in 2003 and 2004 respectively reported discussing the mathematics content of their lessons with coaches “at least weekly.” Teachers also reported high rates of coaches “locating mathematics materials or supporting . . . use of them” and “providing ideas for mathematics lessons and activities, as well as co-planning lessons (see Table 6.5).
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Observing your teaching of mathematics</td>
<td>21.90%</td>
<td>22.0%</td>
<td>5.5%</td>
<td>7.7%</td>
<td>17.8%</td>
<td>28.6%</td>
<td>28.8%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Co-planning a mathematics lesson/unit with you</td>
<td>18.9%</td>
<td>30.8%</td>
<td>4.1%</td>
<td>6.6%</td>
<td>23.0%</td>
<td>18.7%</td>
<td>35.2%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Conferencing with you before/after your class is observed</td>
<td>20.5%</td>
<td>30.8%</td>
<td>6.8%</td>
<td>8.8%</td>
<td>19.2%</td>
<td>20.9%</td>
<td>24.7%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Modeling mathematics lessons for you</td>
<td>20.3%</td>
<td>27.5%</td>
<td>6.8%</td>
<td>11.0%</td>
<td>29.7%</td>
<td>18.7%</td>
<td>21.6%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Co-teaching a mathematics lesson with you</td>
<td>43.2%</td>
<td>39.6%</td>
<td>2.7%</td>
<td>8.8%</td>
<td>23.0%</td>
<td>14.3%</td>
<td>13.5%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Assisting you in analyzing student mathematical thinking</td>
<td>11.0%</td>
<td>18.7%</td>
<td>6.8%</td>
<td>5.5%</td>
<td>34.2%</td>
<td>31.9%</td>
<td>26.0%</td>
<td>11.0%</td>
</tr>
<tr>
<td>Assisting you with classroom management and discipline</td>
<td>39.7%</td>
<td>41.1%</td>
<td>0.0%</td>
<td>5.6%</td>
<td>26.0%</td>
<td>12.2%</td>
<td>15.1%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Assisting you in working with other teachers</td>
<td>30.1%</td>
<td>22.0%</td>
<td>4.1%</td>
<td>8.8%</td>
<td>28.8%</td>
<td>22.0%</td>
<td>12.3%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Locating mathematics materials and/or supporting your use of them</td>
<td>6.8%</td>
<td>12.1%</td>
<td>1.4%</td>
<td>2.2%</td>
<td>28.4%</td>
<td>29.7%</td>
<td>35.1%</td>
<td>18.7%</td>
</tr>
<tr>
<td>Providing ideas for mathematics lessons and activities</td>
<td>8.1%</td>
<td>11.0%</td>
<td>1.4%</td>
<td>6.6%</td>
<td>27.0%</td>
<td>27.5%</td>
<td>55.1%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Discussing mathematics content</td>
<td>8.2%</td>
<td>8.8%</td>
<td>1.4%</td>
<td>2.2%</td>
<td>19.2%</td>
<td>25.3%</td>
<td>45.2%</td>
<td>24.2%</td>
</tr>
</tbody>
</table>

Table 6.5. SVMI Survey Respondents’ Self-Report on Activities Completed with Coaches

Coaches also often co-taught lessons, assisted teachers in analyzing student work, and observed teachers teaching. Survey respondents reported that coaches least often helped them to work with other teachers and to assist them with classroom management and discipline.

When asked how much impact various aspects of the SVMI experience had on their professional growth, SVMI respondents reported that they gained a good or great deal from coaching (63.1% in 2003 and 48.4% in 2004 answered 4 or 5 on a 5-point Likert scale) and from participating in MAC professional development (67.3% and 31.9% respectively) (see Table 6.6). The Summer Coaching Institute, Summer Lab/Lesson Study Institute, and participating in the administration of MARS assessments also were viewed as having a significant impact on their professional growth. Of the 40-50% of respondents who used problems of the month in their classrooms, 31% and 24% (in 2003 and 2004 respectively) found them helpful; 31% and 29% found local district workshops that focused on the MARS results helpful. Fewer respondents had participated in lesson study, thus fewer reported those activities as having an impact on their professional learning.

32 This resonates with a study conducted by SVMI staff which claimed that students of teachers with coaching have high scores on the SAT-9 (Noyce Foundation, 2004).
Table 6.6. Survey Respondents’ Evaluation of the Impact of Various SVMI Activities on Their Professional Growth

<table>
<thead>
<tr>
<th>Activity</th>
<th>Not At All</th>
<th>2</th>
<th>Somewhat</th>
<th>4</th>
<th>To a Great Extent</th>
<th>Did Not Participate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving coaching</td>
<td>1.3</td>
<td>3</td>
<td>2</td>
<td>12.1</td>
<td>18.4</td>
<td>23.1</td>
</tr>
<tr>
<td>Participating in MAC professional development</td>
<td>1.3%</td>
<td>6.4</td>
<td>2.6</td>
<td>15.6</td>
<td>27.3</td>
<td>11.7</td>
</tr>
<tr>
<td>Participating in Summer Coaching Institute</td>
<td>1.3</td>
<td>2.2</td>
<td>2.6</td>
<td>10.1</td>
<td>25.8</td>
<td>27.3</td>
</tr>
<tr>
<td>Participating in Summer Lab School/Lesson Study Institute</td>
<td>1.3</td>
<td>3.3</td>
<td>1.3</td>
<td>3.9</td>
<td>9.2</td>
<td>14.1</td>
</tr>
<tr>
<td>Participating in the administration and scoring of MAC scoring items</td>
<td>3.9</td>
<td>2.2</td>
<td>5.2</td>
<td>6.5</td>
<td>20.8</td>
<td>18.3</td>
</tr>
<tr>
<td>Using the “The Problem of the Month” in class</td>
<td>1.3</td>
<td>2.1</td>
<td>3.9</td>
<td>5.3</td>
<td>21.1</td>
<td>18.1</td>
</tr>
<tr>
<td>Participating in local district workshops discussing/analyzing results of MAC tests (e.g., Tools for Teachers)</td>
<td>1.3</td>
<td>6.5</td>
<td>14.3</td>
<td>7.6</td>
<td>33.8</td>
<td>34.8</td>
</tr>
<tr>
<td>Participating in a lesson study group</td>
<td>1.3</td>
<td>2.2</td>
<td>2.6</td>
<td>1.1</td>
<td>26.6</td>
<td>5.4</td>
</tr>
<tr>
<td>Attending a public lesson study session</td>
<td>0.0</td>
<td>4.3</td>
<td>2.7</td>
<td>5.2</td>
<td>4.0</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Summary

In conclusion, both programs offer teachers a network of opportunities to learn. Some are formal, some less so. Some are located in teachers’ schools, others require that teachers go to other schools, school district offices, or a local museum or university. Sometimes teachers are actively physically engaged – writing lesson plans, critiquing videotapes, analyzing student work, scoring student papers, solving mathematics problems, writing essays. At other times, teachers are allowed to sit back and watch models of teaching or listen to speakers. When asked, participants largely report that activities less formal, more “practical” and “relevant,” and closer to their classrooms are the most helpful.

But we do not want to take teachers’ reports at face value, for several different reasons. First, there are the well-known problems with self-report and memory (e.g., Schacter, 1999). Related to that, teachers might be confusing proximity or frequency with helpfulness – they report on what is more recent or familiar – classic threats to validity – and not on what has the most impact on their learning. Finally, based on our analyses of the qualitative data collected in interviews and observations, we noticed several factors that appeared to consistently shape what teachers learned. We now turn to a description of those factors.
Part 7:  
What Factors Shape Teacher Learning?

It . . . became clear during our analysis that the program is but one factor contributing to the
new teacher’s sense of preparedness. Also important are the skills and experiences of
individuals who enter the program as well as the support they received in the schools where
they begin their teaching. (Johnson, Birkeland, & Peske, with Munger, 2005, p. 93)

Education reforms that intend to shape classroom practice enter schools that are
busy, conflicted places and the relationship between a reform’s ideals and what ends up
in a teacher’s classroom is fraught with complexity. The complexity is no surprise, for
previous research has demonstrated how heartbreakingly hard it is to change teaching
and schooling. Indeed, these two professional development programs took pains to
build on lessons learned from past reforms. Our goal here is to identify and describe the
major factors that played a role in what teachers learned and when. Like Susan Moore
Johnson and her colleagues, we identified two clusters of factors: those related to
teachers and those related to the schools they worked in.

Teacher Characteristics

David Cohen, Stephen Raudenbush, and Deborah Ball (2003) argue that teachers
have personal “resources” that are both the targets of reforms and the mediators of
reforms. In a similar vein, activity theorists and sociocultural theorists suggest that
teachers and students have “funds of knowledge” that influence and shape what they
learn in various activity settings (e.g., Lave, 1996; Moll & Diaz, 1992; Moll &
Greenberg, 1993). The teachers brought different personal resources to the process of
learning the lessons that ECRW and SVMI offer. For our case study teachers, two
interrelated teacher personal characteristics played a major role in how they
encountered, reacted to, and used the ideas and materials offered by SVMI and ECRW:
(a) teachers’ personal enthusiasms for professional development and (b) their entering
knowledge and experience.

Enthusiasms for professional development. Participants in both programs
varied in terms of their enthusiasms for professional development, for learning about
teaching, for thinking critically about their teaching, and for learning about their
students. And their appetite for professional development was an important factor in
explaining when and why different teachers respond to the ideas they encounter in
SVMI and ECRW. We return to Maggie Diamond.

A year before we met Maggie, she was the only teacher in her school to respond to
an invitation in her mailbox to take part in SVMI. After we met, she participated in
monthly Math Network meetings and summer institutes, and worked closely with one of
SVMI’s most talented coaches. She described these experiences as “life changing,”
and especially appreciated her work with her coach.

But Maggie has been dedicated to the practice of examining and expanding her own
teaching long before she joined SVMI. For 20 years, she had been searching out and
putting into place new ideas. Her energy and motivation were rooted in an almost
insatiable desire to help underprivileged children. Coming from a large family without
much means (12 children), she had a permanent place in her heart for the needy, and she
has acted on that compassion in various ways throughout her life. A number of years
ago, while living in Michigan, Maggie started a book club for poor children on the
Upper Peninsula. Maggie worried that these children were learning to read with
leftover books -- junk nobody wanted. Traveling door-to-door, she scraped together
funds from local businesses to buy the children quality literature.
Later, when Maggie moved to California, she became interested in the large number of families of Spanish-speaking migrant workers that had recently moved to her previously White town. The children of these families struggled in her school, where almost none of the teachers (including Maggie, at the time she moved there) spoke Spanish. She also noticed that the families were hesitant to become involved in the children’s school life. Deeply concerned, Maggie started a “homework club” in the neighborhood where many of the children lived. Every afternoon, she helped a number of students get started on their homework by offering a structured place for them to work. What started off as a small group grew (in just a few years) into a large group consisting of over 100 students. Maggie managed this group with the help of several other school volunteers. The parents began to trust Maggie, developing much closer connections to the school. More and more parents began attending school functions, and many requested that their children be in Maggie’s class.

For years, Maggie has acted bravely to make change. We came to see her as an “opportunivore,” taking advantage of practical openings for educational improvement. She does not wait to formulate broad, generalizable theories of what she is going to do next. Instead she acts according to a principle much like John Dewey’s (1938) pragmatic notion of “flexible purposing,” constantly reevaluating the complex, changing circumstances of the classroom, and changing something when it seems appropriate and she discovers a helpful strategy or tool.

It is this quality of Maggie that made her an especially good fit for SVMI. SVMI works by surrounding its teachers with as much valuable educational matter as possible. Participating teachers do not have to reach far to grab useful resources. A flexible, opportunistic teacher like Maggie can choose from last week’s professional development session or this week’s coaching session, and find an educational nugget that is just right. Like a zealous graduate student, Maggie always has a long list of things she wants to talk about and a pile of articles she is reading. SVMI feeds her fire by constantly exposing her to new ideas about content and pedagogy.

Gail Ralston, one of our ECRW teachers, displayed similar enthusiasms for new teaching ideas. She participated in a book study group in her school, attended Saturday Speakers series, and eagerly accepted the invitation for coaching when it was offered. Because she does not presume to have teaching “all figured out,” she was open to new learning. Lynn Westmiller too was an example of the power of teachers’ commitments to their own professional learning. An avid reader, she often pointed to specific professional reading as a source for many of the teaching practices we observed. She valued the reading group that she attended at her school, as well as the opportunities she had within the district to demonstrate and then discuss her practice with other teachers. She found conversations with other teachers valuable because they allowed her to “step back and get a bigger picture instead of just being so involved in the day-to-day-to-day grind.”

It is not surprising that the majority of our case study teachers were eager consumers of professional development: volunteering for this research project was just one more thing that they were willing to take on. But other teachers experienced ECRW and SVMI in very different ways. Some leapt on the chance to participate, others were encouraged by their colleagues to join in. Other participants were told that their participation is mandatory. Thus, the programs dealt with teachers who had very different appetites, different readiness, both for SVMI or ECRW in particular and for professional development more generally. We met resistors in both programs who were not ready to change their teaching or were ready but were skeptical of the teaching ideas promoted by these programs. Both programs alienated teachers who were not as progressive in their ideas of teacher-student roles, or the work of teaching more generally. We frequently also heard of non-adopters from principals and coaches. A regular request at meetings for principals (recall that each program designs
professional development for school leaders) was assistance for principals working with teachers who resisted these ideas.

Whether a teacher was open to the ideas of SVMI and ECRW mattered. Yet as we have already seen, openness and enthusiasm do not translate directly into reformed teaching. Another factor that was clearly related to when and how teachers learned was participants’ prior knowledge and experience.

Prior (mathematical and pedagogical) knowledge and experience. The case study teachers constantly told us about their frustrations with not knowing enough about mathematics and writing. While their experiences in the programs helped them become less intimidated by writing and mathematics, every case study teacher explicitly acknowledged how much more he or she had to learn, both about the subject matter and about teaching subject matter.

Nonetheless, teachers who had previous experience with similar professional development or with similar immersion in “doing” the subject matter were positioned quite differently to learn from SVMI and ECRW. For example, Lynn Westmiller had been practicing reading and writer’s workshop for several years before ECRW knocked on the door of her school. She had participated with the New Standards Project, and had read a number of relevant texts, including the work of Lucy Calkins. As a result of those experiences, alone she began to put those ideas into practice in her 3rd grade classroom and had seen remarkable results in her students’ writing. Thus, she was poised to pick up and run with the ideas from ECRW.

Gail Ralston, on the other hand, had not participated in such prior experiences. She was exposed to the reform for the first time in the summer institute. She had never given a lot of thought or attention to the craft of writing. In fact, from her description of past practice, she had focused almost exclusively on conventions and structure. Thus, the reform was very far away from her current practice when she encountered ECRW. Thus, she was on a different point on what we came to understand as her “learning trajectory.” We explain what we mean by that.

Both SVMI and ECRW are driven by very clear normative visions of what high quality teaching and learning looks like. But no one encounters a new idea—no matter how compelling—and instantly imports that image in his or her own classroom. Thus teachers need time to tinker, to adapt, to gradually change their practice over time. Furthermore, it remains unclear just exactly how teachers learn over time. Do they have to change their behavior first? Or their beliefs (e.g., Guskey, 1986)? Is one’s ability to teach in a certain way related to one’s values about the role of a teacher or how students learn? Other questions concern reasonable expectations: How much is enough change or growth? When, coaches wonder, should I be happy with the incremental changes I am witnessing? Change is relative, and for one teacher a change might seem enormous, while the very same change might seem minor to another teacher, a coach, or a professional development leader (e.g., Cohen, 1990).

We saw this often in our observations of both professional development events like Math Network meetings and summer institutes. A novice teacher or a novice to professional development would learn something entirely different from what a more experienced teacher would, even on the same occasion. One teacher would discover that math can be fun to explore or that she is capable of learning—and understanding mathematics, another would be digging into the mathematics and struggling with a specific proof. One teacher was learning that she could learn mathematics, the other was learning a particular mathematical idea. Each told us that they were learning a lot.

Both programs were sensitive to these developmental differences. In fact, ECRW—through the WWIS rubric—developed an explicit map of “stages” of implementation. This work was enhanced by speakers, who themselves would talk about the gradual
evolution of teachers’ practice. Lockwood Zisa (2002), for example, spoke with principals about the challenges of “growing the writer’s workshop as a leader,” differentiating between the differences between the features of writer’s workshop in a beginning teacher’s classroom (e.g., “students know where they are in the writing process,” “there is some attempt to establish or utilize partnerships,” “teachers ‘jot’ next to writers, moving toward actual conferencing”) and the features of teachers’ practice when they are progressing toward a more mature version of the workshop (“mini lesson architecture more consistent,” “conferring more focused,” “students have a clear understanding of the stages of the writing process,” “partnerships are a fundamental part of the writing process”).

In much the same way, SVMI laid out a sequence of teaching — albeit less developmentally, and more evaluatively conceptualized — in the Mathematics Teaching Rubric. In that rubric, teaching can be exemplary, successful, improving, or limited. Teachers who are successful or exemplary demonstrate their effectiveness through the use of worthwhile tasks, creating a certain kind of learning environment, using particular instructional strategies (“Limited” teachers direct — rather than orchestrate — the class.), and uses a broad array of appropriate representational and instructional tools like computers, graphs, metaphors, manipulatives, and the like.

We did not assess our case studies along these dimensions at the beginning of the study (since the scales were developed during the time we were conducting the research). Had we done so (using the programs’ rubrics or other means), we might have been able to graphically represent the growth trajectories of each teacher. Ideally, for example, no matter where they began, teachers would be expected to reach some ideal of increased content knowledge and increased pedagogical knowledge and skill (see Figure 7.1).
Progressive teaching ideas

Normative Programmatic View of Instruction and Content

Traditional teaching ideas

Figure 7.1. Mapping Teachers’ Learning Trajectories

This diagram, obviously, oversimplifies the image of such trajectories, in part because teachers are on different “clocks” in terms of their development, which would change to slopes of the trajectories in Figure 7.1. Furthermore, there is no “end state” to the potential development of these teachers, for there is always more to learn: about mathematics or writing, about children and their thinking, about new strategies to use.

Ironically, of course, teachers with more appetite for professional development are often in the best position to get the most out of new learning opportunities as they are presented. Hence, professional development programs can suffer from a “the rich get richer” phenomenon. However, as our cases have already highlighted, teachers who are excited by the ideas they encounter are not necessarily equipped to pull those ideas off in their classrooms. With limited funding, teachers who were “well launched” lost support (like Maggie and Jerry in SVMI), and it was not clear to us that they would be able to stay on such a trajectory without the support and resources provided by the programs. That is, they might reach a plateau and not be able to move forward.
However, in addition to the alignment of prior knowledge and experience with these professional development programs, we also believe that another factor shaped how much teachers picked up or struggled with the ideas of these reforms. Both ECRW and SVMI are built upon assumptions learners and learning. The staff believe that all children can learn, and that all children should and can participate in classroom discussions. They believe that knowledge is co-constructed in communities, and that students need to participate actively in the construction of their knowledge of writing and/or mathematics. So when teachers in SVMI or ECRW learn to ask students questions, it is not just for show, or out of some sense that children need to talk to keep them interested. Teachers are taught to ask children questions because the teachers need that information to make their next pedagogical decisions. Students’ ideas, then, are fundamental to the teaching and learning that happens. Direct instruction, in this context, is considered poor instruction (save for the occasions created for mini-lessons in ECRW).

It was our experience that teachers whose ideas about students or teacher-as-authority were not aligned with this sentiment and value system had much less success putting the ideas and materials of SVMI and ECRW into practice. Gail Ralston, for instance, was a well-intentioned teacher. But her ideas about students were in conflict with the assumptions of ECRW staff. She took an almost missionary-like in her attitude toward her students: They needed “salvation” and she was the source of all important ideas and knowledge. Consequently, Gail had problems implementing ECRW, most of which appeared to be management issues, but many of which, we believe, had their origins in her belief that she was the source of all knowledge in the class and students needed her to answer all their questions (thus, she wasn’t able to work to build student independence in her classroom). Ms. Ralston wanted to do the right thing, but the urge to help students led to a kind of pedagogical impatience: she simply could not wait until other students explored ideas and answered each other’s questions. It seemed like she felt a moral obligation to insert herself.

Kathy Dunbar, an SVMI teacher we worked with, also struggled to understand when and under what conditions the “Noyce way” was appropriate for students. A theme across our discussions with Kathy was that she felt pulled by two antithetical forces. On one hand, her entire middle school math department had a relationship with one of Noyce’s highly respected and well known coaches. The coach helped plan and run professional development sessions, worked closely with Bay Area teacher education programs, and published scholarship on teacher education. The coach also worked closely with new teachers (planning sessions, observations), and was a resource for teachers who have already worked with her for 1–2 years (Kathy has been there for 5 years). In the past, Kathy’s coach ran weekly planning sessions with all of the teachers at the school, but these “dried up” due to a lack of funding. In richer times, the coach also brought the entire department to Noyce’s monthly professional development sessions, but gradually only 1–2 new teachers were able to be paid release time so that they could attend these sessions.

On the other hand, however, in the two years we observed Kathy, she felt the pressure of a new principal with a scripted traditional agenda that contradicted much of what she learned from Noyce. Kathy felt pressure to teach to traditional standards, follow a very – in her words – “closed approach” textbook, and drill students with a set of competitive worksheets (called “accelerated math”) that take a very traditional approach to mathematics and, in effect, ranked her students.

In most of our conversations with Kathy, we heard a clear preference for and understanding of the Noyce way. She emphasized, in detail, the tenets of progressive mathematics education as supported by Noyce and her coach. She reflected on student thinking, talked about how the participation structures in her classroom supported learning, and promoted tasks and curriculum that encouraged conversation, thinking, and learning. In her classroom, however, we saw a much more traditional approach.
On the surface, it looked like a progressive classroom. Students sat in groups of four, Kathy called upon students to present answers to the class, and she told them frequently to test out explanations and ideas on her and on their neighbors.

When the class actually got rolling, however, the mathematical discourse at the tables of four was mixed. Indeed, students presented solutions, but often Kathy remained the authority. Perhaps most important were the different experiences afforded to the “good” students and “weak” students. On one level, this difference could be seen between Kathy’s “accelerated” class and the “regular” and “SDAIE” (Specially Designed Academic Instruction Delivered in English, meant to be an oasis of learning for ELL students) classes. The classes looked and felt very different, with Kathy playing the role of a more traditional teacher in the weaker classes. In those classes, she spent much more time talking, as well as using a much more authoritative — at times even impatient — tone with the students.

This difference was also apparent in Kathy’s reflections upon her classes. She often talked a bit resignedly about the lower-level classes, describing them as needing more work with the accelerated math worksheets. This assumption — that more progressive, student-focused pedagogy is only appropriate for more advanced students — is common among many educators, but it is the antithesis of the SVMI and ECRW assertions that progressive content and pedagogy is critical to enabling the learning of all students. Noyce’s approach strives specifically to reduce the achievement gap, and the materials they offer are designed for all children. Furthermore, when student learning data are collected on both programs, analyses are conducted to look at these differences in particular. Concern about the learning of all students is never far from any staff person’s mind.

Kathy explains some of her compromises as necessary considering where the students are heading next. She compares the schools to which these students are heading to a well-known successfully “progressive” school in the area. Her students, unlike the students at that school, would be entering traditional algebra classes and — according to Kathy — more drilling and individual practice was necessary to prepare them for their classes. Given that “reality,” Kathy believed that some of the compromises her principal demands were, in fact, a good thing.

Kathy’s case reminds us that the “causes” of teachers’ behaviors are multiple and often not easily disentangled. Why did Kathy implement the Noyce ideas differentially? In part, there were the messages from her principal. But there were also her own ambivalent ideas and beliefs about whether all students were capable of learning in the ways touted by the Foundation. Across the board, we saw teachers embrace the ideas of these professional development programs in less and more enthusiastic and apposite ways, and the personal resources they brought — their prior knowledge and experiences, their appetite for professional development and new ideas, and the degree of alignment between the programs and their experiences, knowledge, and beliefs — shaped how they picked up and used the ideas offered by SVMI and ECRW. Lynn Westmiller had been experimenting for three years with the kind of practice being advocated by ECRW. In Ms. Ralston’s case, it was a whole new game — she had never facilitated a writer’s workshop, she’d never used — let alone developed — a rubric. In addition, underneath the practices being advocated by ECRW is a foundation — not only of how the content is being defined — but also of how teaching and learning are defined and who can learn. In the past, Ms. Ralston defined her role as the arbiter of convention, as the expert who corrected papers. Now, she was being asked to change her role and she talked often about her goal of helping students live the writerly life, a phrase taken directly from ECRW. To her, it seemed that it meant students should become more independent in their writing, but it was not clear what her role should be. In the conferences we observed, she was still — most often — doing the correcting. This example helps illuminate the complexity of conceptually modeling the processes of teacher learning: One teacher has relevant prior knowledge and background, both have a commitment to

Teacher Learning from Professional Development

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change, but each teacher might have different conceptions of what their roles are. These personal resources mediate teachers’ learning; this resonates with the work of policy analysts who have found that policy success (and we are here program success) critically depends on both capacity (teachers’ knowledge, for instance) and will (McLaughlin, 1987). We return to these ideas later in this report when we present a revised model of teacher learning (see Figure 9.1).

But these personal resources were also tangled up with school characteristics. Like Kathy, all of the teachers in our study worked in contexts where principals, other teachers, and policy documents like frameworks, tests, and the like carried messages about how and what they should teach.

School Level Characteristics

*We know from both first hand experience and from a number of more formal investigations that teachers’ instructional practices are profoundly influenced by the institutional constraints that they attempt to satisfy, the formal and informal sources of assistance on which they draw, and the materials and resources they use in their classroom practice.*

(Cobb, McClain, Lamberg, & Dean, 2003, p. 13)

A second set of factors that shaped what teachers learned in and from SVMI and ECRW concerns school variables, including: (1) policy pressures, including issues of accountability and curriculum collision; (2) leadership; and (3) school culture. We discuss each briefly.

**Policy pressures.** The schools in which SVMI and ECRW teachers teach receive and respond to multiple, sometimes conflicting messages about teaching and learning. This is an issue for as Desimone, Porter, Birman, Garet, and Yoon (2002) found, the alignment of professional development to other policies (like standards and assessments) was a hallmark of higher quality professional development. While both professional development programs were consistent and coherent about the messages being sent to teachers, those teachers worked within schools with coexisting policy pressures. When asked in the survey about what influenced the content they taught and the instructional methods they used, SVMI teachers reported that state and district standards were the most influential, followed by professional development and then district and state assessments (see Table 7.1).

Two concerns about the policy context repeatedly arose in our conversations with teachers — accountability and curriculum collision — which were most often seen as intertwined.

The curricular clash — perceived or real — between the content and pedagogical commitments of these programs and the adopted curricula that teachers worked with was repeatedly mentioned by our case study teachers and the program staff. For example, in ECRW, teachers learned to teach and to assess student writing in ways quite different than what is promoted in some of the textbooks that were adopted. Helping teachers negotiate the tensions between different images of both writing instruction and the assessment of student writing became focal in the coaches’ work with ECRW participants.

SVMI staff and coaches reported similar struggles:

*The MARS tests help us keep [students being able to explain their answers] in our curriculum. . . . There is a wall . . . closing in on us and that wall is the California standards. It keeps us pressured to focus on a few things. Especially with middle school, because the standards are horrible. And we have to use this computer program for math*
skills to help students with the testing, so it seems to stress out all of the teachers. And with that program it is all skills-based. That is not teaching; it is all testing. (SVMI Coach)

Because testing messages were so powerful and strong in California, accountability and curriculum became almost interchangeable for many teachers as tests began to control what was taught. For example, during the second year of our observations, in response to declining standardized test scores, two schools where ECRW case study teachers worked adopted Houghton Mifflin, a scripted reading program which was in direct conflict with the reader’s and writer’s workshops advocated by ECRW. The former put all of the responsibility on the shoulders of the teacher, the latter presumed that students had to share responsibility for the selection of topics, and that their interests were an important driver for instruction. Teachers were forced to change what they taught so that the school might have higher test scores the following year.

<table>
<thead>
<tr>
<th></th>
<th>No Influence</th>
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<th>Moderate Influence</th>
<th>Major Influence</th>
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<td>9.2</td>
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<td>6.2</td>
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<td>17.6</td>
<td>14.4</td>
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<td>13.4</td>
<td>25.0</td>
<td>25.8</td>
</tr>
<tr>
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<td>10.3</td>
<td>18.1</td>
<td>12.4</td>
</tr>
<tr>
<td>Professional journals</td>
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<td>47.3</td>
<td>43.8</td>
</tr>
<tr>
<td>Textbooks</td>
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<td>8.2</td>
<td>45.3</td>
<td>30.9</td>
</tr>
<tr>
<td>Parents</td>
<td>6.7</td>
<td>25.5</td>
<td>52.0</td>
<td>43.9</td>
</tr>
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</table>

Table 7.1. SVMI Survey Respondents’ Reports of the Differential Influence of Forces of Curriculum and Instruction

At one point, Foster, the Director of SVMI, went so far as to see the environment as “hostile”:

The work we are engaged in is taking place in a hostile context. We face the huge challenge and roadblocks that come from the myriad state policies and programs such as the State Standards, STAR test, API ranking, State Math Framework, High School Exit Exam, the push for algebra early, retention, tracking, sanctions, the focus on direct instruction, and the emphasis on basic skills and procedural knowledge. The next large obstacle is the state math textbook adoption. Each school district is struggling with the challenge of adopting poorly written and traditionally designed textbooks. (Foster, 2001)

As researchers, we did not always consider the press to demonstrate student learning and the push toward higher quality curriculum and standards as “hostile.” Nor, upon examining the various textbooks available to school districts, were they unilaterally “poorly written” or “traditionally designed,” and since teachers reported that those textbooks had very little influence over how and what they taught (see Table
7.1, it was not clear to us that textbook adoption presented as challenging an obstacle as portrayed by SVMI staff. It was clear, however, that the pedagogical ideology of SVMI was in direct conflict with the state’s less progressive stance. SVMI was not just about rich mathematical problems or alternative assessments. It was also against direct instruction, for staff saw the two – working on problems and students making their ideas and reasoning public – as intertwined. This tangling up of content with pedagogy is an old, heated debate in education (e.g., Hirsch, 1996; Ravitch, 2000; Wilson, 2003). And SVMI leadership held firmly to its progressive roots, fighting the “good fight” for progressive education in the face of considerable criticism within the state and across the country.

As those battles raged, however, teachers go to school and teach, and the curricular “wars” so prominent in the newspapers tended not to be central to the work of schools. Nonetheless, the case studies teachers told us that they were sometimes “caught in the middle” between the progressive ideas of the Noyce programs and (especially in failing schools), the more educationally conservative ideas of policymakers and educators who wanted teachers to teach “traditionally” from (sometimes scripted) curricula. Test scores became increasingly important, and teachers were required to change their curriculum and teaching to raise those scores. If those changes ran counter to the principles and practices of SVMI and ECRW, we sometimes saw teachers throw the reform ideas out entirely. At other times, like in the case of Kathy, we saw teachers save the ECRW and SVMI practices and curricula for the “advanced” students who did not need “the basics.” A smaller number of teachers rejected the press to “prep for test” and presumed that if students were taught to do well on the performance assessments, they would do well on the standardized tests.

**Leadership**

*Principals must create schools that are continuously developing the social capital that allows people to trust, depend on and learn from each other. But an effective instructional leader also needs to build intellectual capital by playing a substantive role in curriculum choices, in establishing expectations for the quality of student work, in analyzing form and quality of teaching and in organizing targeted opportunities for teachers in the school to learn the specifics of teaching their subject matters well.* (Fink & Resnick, 2001, as cited by Lockwood Zisa, 2002)

A second school factor that was clearly important was school leadership. Recall that part of the Foundation’s theory of action is a system-wide view of capacity building; change has to occur at all levels of the system in order to sustain reform. Furthermore, sets of policies and practices must cohere. Mixed, conflicting, or inconsistent messages undercut the energy, commitment, and enthusiasms needed to make permanent change. Both SVMI and ECRW designed opportunities to learn for school administrators, events intended to help them develop the skills and knowledge they needed to develop the social and intellectual capital that Virginia Lockwood Zisa refers to above. ECRW principals learned about setting “mini-goals” as “stepping stones” in their work with assisting teachers. They learned about “learning walks” or “walk throughs,” about appropriate development expectations for teachers learning to adopt writer’s workshop, how to structure and use monthly staff meetings, how to write with one’s staff.

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33 We note here that when we call the Noyce orientation “progressive,” we are referring to the commitment in both ECRW and SVMI to put students firmly in the center of instruction, and to encourage teachers to be less the-source-of-all-knowledge. The Noyce programs, however – especially in their commitment to the collection of data – were not identical with other progressive programs. We do not claim here that these programs are identical; we simply refer to the Deweyian (Dewey, 1902) placement of the child in partnership with the curriculum.
Teachers reported leadership as a critical resource for their implementation of ECRW and SVMI. Ms. Westmiller and the coach who worked at her school frequently discussed the importance of the principal’s leadership. In one interview, Lynn’s coach, like Ms. Westmiller, pointed to the important role of the principal: what is “very critical to success of any program in a school is that . . . the principal’s behind it. If they’re not behind it, then I don’t see it probably going forward even.” The principal at Simon Elementary took an individual interest in each teacher’s development and Lynn believed that this principal was serious about creating a community of dedicated professionals who were knowledgeable about instructional developments in the field of writing. While we did not hear this kind of praise for principals across the board, there were other occasions when teachers and coaches pointed out to us that having a principal who was a “true believer” made a significant difference in what they were able to do in their classrooms and, subsequently, learn.

We should also note that how principals interpreted their role and the reforms also mattered. For instance, Gail Ralston told us that when her principal visited her classroom, she would be watching for how well students moved to and from the carpet, and other organizational issues. Lynn, on the other hand, reported having conversations with her principal about the nature of her mini lessons — and how she’d generated the topics for those lessons and her goals for what students would learn from the mini lessons. Although we collected no data on how much the principals knew about ECRW and writer’s workshop, it appeared to us that Ms. Ralston’s principal was in the early stages of understanding the reform, focused as she was on surface features of Gail’s classroom. In contrast, we saw Ms. Westmiller’s principal at summer institutes, including an Advanced Institute where she too graded student papers, discussed instructional next steps with teachers, and deliberated over what constituted a good piece of writing. She seemed to understand the ECRW materials and ideas in a qualitatively different way.

Our survey results suggest that most teachers felt supported by their principals. In 2004, when asked about principals and their support, over 48% agreed and 39% strongly agreed with the statement, “My principal is supportive of my work with SVMI” (see Table 7.2). In general, SVMI survey respondents reported a supportive school climate in which other teachers supported each other as they tried out new ideas, an administration that promoted innovation, and teachers who both knew each other and met regularly to work on curriculum and instruction.
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</thead>
<tbody>
<tr>
<td>I feel supported by other teachers to try out new ideas in teaching</td>
<td>0%</td>
<td>2.1%</td>
<td>12.5%</td>
<td>10.3%</td>
<td>43.1%</td>
<td>57.7%</td>
<td>41.7%</td>
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<td>The school administration promotes innovations in education</td>
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<td>0%</td>
<td>12.3%</td>
<td>16.3%</td>
<td>56.2%</td>
<td>45.9%</td>
<td>30.1%</td>
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<tr>
<td>Teachers in this school regularly share ideas about instruction</td>
<td>21.9%</td>
<td>21.9%</td>
<td>47.9%</td>
<td>31.8%</td>
<td>27.4%</td>
<td>19.8%</td>
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<td>41.1%</td>
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<td>I regularly work with other teacher(s) on curriculum and instruction</td>
<td>13.9%</td>
<td>24.7%</td>
<td>54.2%</td>
<td>35.1%</td>
<td>26.4%</td>
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<td>I plan and coordinate instruction with other teachers</td>
<td>18.1%</td>
<td>N/A</td>
<td>48.6%</td>
<td>N/A</td>
<td>25.0%</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don't know how other teachers in this school teach</td>
<td>20.8%</td>
<td>23.7%</td>
<td>47.2%</td>
<td>39.2%</td>
<td>19.4%</td>
<td>30.9%</td>
<td>5.6%</td>
<td>2.1%</td>
</tr>
<tr>
<td>My principal is supportive of my work with SVMI</td>
<td>N/A</td>
<td>0.0%</td>
<td>N/A</td>
<td>4.1%</td>
<td>N/A</td>
<td>48.5%</td>
<td>N/A</td>
<td>39.2%</td>
</tr>
</tbody>
</table>

Table 7.2. **SVMI Survey Respondents’ Views of School Climate**

Similarly, when asked whether they felt supported by their principals, ECRW survey respondents reported that they felt supported by their principal (45% agreed and 47% strongly agreed with the statement, “My principal is knowledgeable and supportive of ECRW”) (see Table 7.3). And respondents also reported that they felt supported by other teachers, and that they regularly participated in discussions about instruction.

---

*N/A indicates that we did not ask the question in that year. We needed to cut the length of the survey in 2004, and many questions were removed in an attempt to increase participation.*
Strongly | Disagree | Disagree | Agree | Strongly Agree
--- | --- | --- | --- | ---
I feel supported by other teachers to try out new ideas in | 2003 | 2004 | 2003 | 2004 | 2003 | 2004 | 2003 | 2004 |
0.0% | 4.2 | 50.0 | 58.1 | 43.4 | 35.1 |
The school administration promotes innovations | 0.8 | N/A | 5.7 | N/A | 45.1 | N/A | 45.0 | N/A |
My principal is knowledgeable and supportive of ECRW | N/A | 0.0 | N/A | 2.6 | N/A | 45.3 | N/A | 46.9 |
Teachers in this school regularly share ideas about instruction | 1.2 | 1.0 | 7.8 | 6.8 | 49.8 | 48.7 | 40.0 | 41.9 |
There is a lot of discussion among teachers about how to teach | 1.2 | N/A | 15.9 | N/A | 49.2 | N/A | 31.3 | N/A |
I regularly work with other teacher(s) on curriculum and instruction | 3.3 | N/A | 11.0 | N/A | 47.6 | N/A | 34.1 | N/A |
I plan and coordinate instruction with other teachers | 2.4 | N/A | 12.6 | N/A | 48.8 | N/A | 32.1 | N/A |
I don't know how other teachers in this school teach | 31.6 | 25.0 | 47.1 | 53.2 | 11.5 | 16.0 | 2.5 | 2.1 |

Table 7.3. ECRW Survey Respondents’ Views of School Climate

School culture

Individual teaching competence must be put to use in an organized, collective enterprise. This element of capacity calls attention to the educative importance of social resources in the school, which we summarize as schoolwide professional community. A strong professional community consists of (a) the staff sharing clear goals for student learning; (b) collaboration and collective responsibility among staff to achieve the goals, (c) professional inquiry by the staff to address the challenges they face, and (d) opportunities for staff to influence the school's activities and policies. (Newmann, King, & Youngs, 2000, p. 263)

This brings us to the third school level variable – school climate – which is intimately related to principal leadership. Our case study teachers worked in drastically different settings in terms of collegiality and shared work. Lani Gibbs participated in lesson study, Lynn Westmiller in a book study group; Pi Day was a collaboration among a group of SVMI teachers. But Gail Ralston and Maggie Diamond worked almost in isolation. ECRW had as part of its design, whole school involvement; with SVMI participants there was more latitude, although there were schools where the entire mathematics department was deeply engaged in SVMI-related activities.

One significant aspect of school culture was how the coach’s role was conceptualized. In some schools, especially early on in the initiatives, coaches were treated like extra “hands,” and they were asked to run errands, take over lunch or playground duty, or act as a substitute teacher. In schools in which principals learned to have a close, collaborative relationship with the coach, coaches became instructional resources. In the best of all circumstances, coaches and principals formed instructional teams. After a day-long visit to Lynn’s school that all of the ECRW coaches attended,
for example, one educational consultant pointed out how closely the principal and the coach worked together at the school. The consultant noted, “They’re careful – they don’t want to lean on one another, but they want to stand next to each one another, working side-by-side.” This team effort to support teacher learning created a school culture that fed and enabled teacher learning.

Our observations of ECRW book groups in different sites gave us additional insight into how different schools – with different cultures and different assumptions about what ECRW was – could offer different experiences for the participating teachers.

One group we observed met almost weekly. While the number of participants varied, there was a core group of six teachers, including the ECRW coach, who participated. Participation was completely voluntary and the group met for an hour before school. This particular group had been actively meeting for three years. Together, they’d read a number of books, including After the End by Barry Lane (1993) (nominated by one of our case study teachers as one of the most valuable professional books she’d read), two works by Katie Wood Ray, a book by Carl Anderson (2000) as well as a number of others that had become standard fare among ECRW teachers.

During one of our observations, we sat in on the group’s discussion of a book that was different than those they typically selected. It was the first novel they’d read together, which was written by Anne Lamott whose book on writing – Bird by Bird (Lamott, 1995) – the group had read together and enjoyed. The novel, Crooked Little Heart (Lamott, 1998), was giving a number of the participants in the group some trouble – in part because of the content and in part because it was a novel, not a professional book about teaching writing. On the day we observed, the coach, facilitating the conversation, opened the discussion with a question about how people were reacting to the character development in the novel.

“Character development? What character development?” one teacher reacted. “The character doesn’t go anywhere. She’s stuck.”

The discussion shifted slightly, however, because some in the group found the nature of the content “sordid” (the central character – Rosie -- is a tennis player who cheats, and the themes of early sexuality, voyeurism, and depression are very much present). Instead of discussing character development, the conversation turned to a discussion about the kinds of books that work for teachers of writing, books that work for students to teach writing, and which sorts of books this group wanted to read. While one teacher reacted to Rosie’s life (which she described as a “train wreck”), another teacher said that the book hadn’t grabbed her, but that she wasn’t repelled by the content. She said she couldn’t relate to this character and added that she repeatedly wanted something more about writing (this might have been because they had all read and enjoyed Bird by Bird).

The group acknowledged that reading a novel together was a departure for them and two participants added that they’d gotten something out of reading it together. Though two members said they’d finish the book on their own, ultimately the group decided that this was not a good choice for this group to read. They nominated several new possibilities for their group, among them, reading some children’s books together that they might use with their students in writer’s workshop and reading a book called Living Between the Lines by Harwayne and Calkins (1990) that builds on Calkins’ earlier work with writer’s workshops.

Several things stood out to us about this book group. Although the group ultimately decided to change course with their selection, they understood that this was not a lost activity or wasted time. Toward the meeting’s end, one teacher raised an important issue – that is, their own capacity to put aside their prejudices about content when students are reading and writing about things that are really important to them.
that we might view as trite or sordid. “One thing I’m getting out of reading this novel is thinking about separating the content from the writing skills,” the teacher observed. She said that even though the reality of the main character’s life was repugnant to her, there is value to the craft with which it was constructed.

As the teachers discussed some alternative children’s books they might read together, one teacher mentioned a district (not Noyce-sponsored) in-service they had attended the day before.

“Yesterday was not about writing, it was about test-taking,” she said.

At the in-service, teachers had been encouraged to include preparation for state standardized tests in their mini lessons – sentence combining, jumbled sentences.

“How many real writers have to un-jumble sentences?” she continued. “Don’t tell me to put these in my mini lesson!”

It struck us here that the teachers had learned a way of thinking both about teaching and about writing through their ECRW participation. The group members took offense at the suggestion that mini lessons might be used to practice the “genre” of test-taking. The thought of jumbling sentences and having students re-order them seemed silly and inauthentic. The test was not aligned with what they understood children needed to know in order to write well. It also seemed clear that the teachers shared a common sense of purpose for the role of writer’s workshops. Deepening students’ understanding of complex concepts like theme or character analysis, writing and revising, these were the sorts of activities that students should do during writer’s workshop (including mini lessons), not test preparation. To use the “container” of writer’s workshop to present content that was not about being a writer was abhorrent.

Another book group we observed was at a school that had decided to read Calkins’ The Art of Teaching Writing. The group was large (about 16 teachers) perhaps because teachers received additional pay for attending it once a month after school. The group was facilitated by the principal, who sat at a table at the front of the room while the teachers were clustered in groups of four. She greeted the teachers and distributed a handout with several questions listed that focused teachers’ attention on the reflections about their own experiences trying to implement some of the strategies they’d read about in Calkins’s book.

The handout opened with a quote from Calkins: “You must always assume that one of the pillars of your thinking is wrong” (p. 119). However, at least in the groups we overheard, no one discussed what some of those pillars might be. The questions focused teachers’ attention squarely on their practices – on strategies they’d tried and whether they thought they “mattered.”

One small group spent the bulk of their time helping one of their members – a new teacher – deal with the challenges she was encountering with reader’s workshop. They gave her advice about creating a library, discussed setting up bins, told her how to acquire books, pointed out which books seemed to draw in what kinds of students, and told her about the organizing schemes might work: by author or level or genre.

The character of the conversation in this book group was qualitatively different in than the group discussing Lamott’s Crooked Little Heart. It was not evident that the discussion we overheard was anything more than a laundry list of possibilities from which the new teacher could choose. This emphasis on procedural concerns seemed quite different than the discussion of values and literature in the first group. The task of judging whether a strategy was good or not seemed superficial, for strategies are only as good as the content they are used to mediate, as was pointed out in the first group’s discussion about mini-lessons and test-taking skills.
Across the schools, we saw this kind of variability in teacher groups, which were fundamentally shaped by the culture of particular schools. Some principals directed teachers’ attention to the “how to,” others engaged teachers in substantive conversations. Although the first group grappled with how to use the novel to their pedagogical ends, they puzzled their way through it. Collectively, they wondered about and worked out a way of using their experiences as readers to inform their teaching. In the second group, experienced teachers had tips for their less experienced colleague. Wondering was not part of the experience, and the school culture did not encourage them to step back and question their own assumptions or practices. ECRW staff envisioned these groups as professionals who deliberated over content and pedagogy, but school culture is powerful and that professional discourse easily reverted to a much more technical “shop talk.”

We saw similar (if not more) variation in school culture in SVMI, perhaps because there is large variability in how many teachers in one school are involved in the program. Often this was due to how much district funding is available for coaches and for leave-time for teachers who wish to attend professional development sessions. For example, in Jerry’s and Maggie’s respective schools, they were both the only teacher participating in SVMI. Maggie, who is self-motivated and confident in looking for ways to improve her teaching, did not seem fazed by the lack of school camaraderie and support. She simply sought collaborators outside of the school. Jerry, who had less experience teaching mathematics, less content knowledge, and less confidence, seemed more hampered by his solitude. He frequently wished out loud for colleagues to talk to about SVMI ideas and materials. He also wished that the school administration understood what he is trying to do.

For other teachers, like Lani and Kathy, the entire department was aligned with the SVMI goals. In Lani’s case, where the main SVMI-related activity was lesson study, each teacher participated in a collaborative lesson study group. Lani saw this group as the main source of her learning. In Kathy’s case, the entire department was mentored regularly by the resident coach. Groups of teachers from the department regularly attended professional development sessions together where they planned lessons, talked to other colleagues, and picked up new ideas.

In sum, a second factor that shaped how and when teachers picked up, used, and then integrated the ideas and materials from SVMI and ECRW into their practice entailed the schools they worked in. The policy environment, the principal’s knowledge/understanding of and attitude toward the reform, and the general school climate in terms of collegiality played important roles in their learning. This context was a Petri dish for teacher learning. As Coburn (2001) explains:

> What sense teachers ultimately made – the way in which they constructed understanding, made decisions to select some approaches and not others, and worked out technical and practical details necessary to enact the interpretation – was deeply shaped by whom teachers were working with and the conditions for conversation. The conditions for conversation were crucial because without the opportunities for deep engagement, without the time and structure to delve into and construct an understanding of messages from the environment and to figure out ways to integrate new practices or ideas into the complex world of the classroom, it was unlikely that messages about reading touched classroom practice. (p. 159)
Part 8: What Opportunities to Learn Appear to Have Greater Effects?

Ideally, when examining what teachers learned from these programs, we would map teachers’ opportunities to learn on to measures of their content knowledge and pedagogical content knowledge. We might then also control for variables like principal leadership and teachers’ entering knowledge and skill given the findings from the qualitative aspects of our investigation. But for conceptual and methodological reasons, we were not able to do that in this research (although in our conclusion we lay out a model that might be used to inform future work).

For this report, instead, we developed several impact scales for SVMI and ECRW; we also selected several items from the surveys as proxies for teacher learning/change. We then ran regressions to identify correlations between opportunities to learn and various measures of impact. We begin each section by describing the independent and dependent measures we used for the SVMI and ECRW surveys (including scales that were developed), and then present the results. We note here that, since this was an exploratory study, these results are meant to either triangulate those that we found in our field work (Parts 5-7), or to generate hypotheses and raise questions.

Method

Our objective in the regressions was to choose predictor variables that describe the outcome variable most accurately, using the results from our interviews and observations to guide our reasoning. In general, multiple regression allows the researcher to ask (and hopefully answer) the general question, "What is the best predictor of . . . ?" In the field study component of this research, we learned that teachers who (1) entered with previous experience with similar professional development; (2) more fully participated in the opportunities to learn offered by the professional development programs; and (3) worked in schools with supportive cultures, including other teachers and their principals were more inclined to (a) acquire new content knowledge; (b) acquire new knowledge of how to teach their content; (c) develop increased interest in learning more; and (d) develop a new sense of their professional obligations and responsibilities.

Because we had survey data on some of these indicants, we wanted to use regressions to test these findings against the larger set of survey respondents. Because a regression model is a linear combination of predictor variables that corresponds as closely as possible to the outcome variable, regressions can be used to answer the following questions:

⇒ Description. How can we describe the relationship between the outcome variable and the predictor variables? How strong is the relationship captured by the model?
⇒ Inference. Is the relationship described by the model statistically significant (i.e., is this level of association between fitted values and actual values

35 “Correlation” is a quantitative index, a standard statistical measurement of the degree of relationship or association between two sets of numbers (variables) to describe how closely they track or are related to one another. The notion does not necessarily imply causation since no direction of influence is known or can be assumed. In fact, often both variables are “caused” by some other independent variable(s) not being measured.
likely to be the result of chance alone)? Which predictor variables are most important?

⇒ Prediction. How well does the model generalize to observations outside the sample? (Lattin, Carroll, & Green, 2003)

To summarize the goodness of fit of the regression line, we compared our uncertainty of prediction without the predictor variables to our uncertainty with the predictor variables. This value -- \( R^2 \) -- is a quantitative measure of the goodness of fit. It is often also called "variance accounted for" (VAF). \( R^2 \) explains the proportion of total variation in the outcome variable that is explained by its linear relationship to the predictor variable(s). When dealing with social science data, typical \( R^2 \) values range between 0.1 and 0.5 (Lattin, Carroll, & Green, 2003). Significance of the overall regression model is tested by looking to see if the VAF is reasonably large. This is accomplished with the F-statistic; the significance of individual predictors in the regression model is tested using t-statistics.

Stepwise regression. Stepwise regression was particularly appropriate for this study, since stepwise regressions are often used in studies that are exploratory in nature (Aron & Aron, 1999), that is, in cases in which the researcher may have a large set of predictors and may want to determine the specific predictors that make a meaningful contribution to the overall prediction. This was the case in this research: the analyses of qualitative data suggested multiple factors to consider in assessing what teachers learned. Here we wanted to test those potential factors in a larger sample by using the survey of SVMI and ECRW participants. Specifically, our analysis used a form of stepwise regression based on a method called "stepwise selection." In this method, the predictor that has the highest correlation with the outcome is entered into the analysis first. Each predictor that enters the regression equation is then tested iteratively in terms of its contribution (in terms of \( R^2 \)) to the outcome variable. That is, if a variable that enters the analysis is measuring the same construct as another, then only the best out of the two variables is retained.

Scale development. To facilitate the use of relevant statistical analyses, some new variables were created. We created these variables either by collapsing survey items, or combining groups of items into scales that were substantively meaningful. The scaled items were generally used as outcome or predictor variables. However, other items that already existed in the survey were also used as outcome variables, without any need for any type of manipulation. To create scales that were statistically reliable and valid, principal components analysis (PCA) with a varimax rotation was used. PCA serves the purpose of determining empirically the number of dimensions that account for most of the variance on the scale and removing items that do not fit well in the constructed scale (Stevens, 1996). Subsequently these scales produced variables that were substantively meaningful and statistically reliable. Reliability is defined as the consistency of the scores that are obtained on the observed variable (Cronbach, 1951; Nunnally, 1978). The alpha reliabilities are reported in Appendix A and B of this report.

Once the scales were developed, we took all of the items labeled as predictors/independent variables and ran the multiple regression with each of the items labeled as outcome/dependent variables. To do so, we used a method of multiple regression called “backward elimination,” which enters all independent variables one at a time into the model and then removes them one at a time based upon the level of significance for removal (the default is \( p \geq 0.10 \)). The process ends when no more variables meet the removal requirement (Mertler & Vannatta, 2002). We now turn to an explanation of the independent and dependent variables that were used for ECRW and SVMI and the results of our regression analyses.
ECRW Independent and Dependent Measures

We developed three scales for the impact of ECRW based on survey responses: teacher confidence, teacher pedagogical content knowledge, and learning in practice (see also Wilson & Mapuranga, 2006). Teacher confidence refers to teachers’ confidence in their capacity to use a broad array of instructional strategies that are both generic and specific to the teaching of writing, and their confidence in managing classrooms and student work. Pedagogical content knowledge refers to teachers’ knowledge of teaching strategies, organizational structures, and teaching/learning theories specific to the teaching of writing. Learning in practice refers to teachers’ self reported enthusiasm for trying things out in their classrooms and learning more about writing and the teaching of writing. The specific items that constitute each scale, and the scales’ item-score correlations and alpha reliabilities can be found in Appendix A.

In addition, we ran regressions on several individual items as well. For example, since principal leadership arose as an important factor in interviews, we searched out an item concerning principal leadership to test its relationship with the scales. Similarly, we wanted to see whether teachers’ own capacity to do mathematics problems and to write was shaped by the professional development, and so we ran regressions on individual items related to those phenomena.

In sum, we had six outcomes for ECRW (see Table 8.1).

<table>
<thead>
<tr>
<th>#</th>
<th>Description (2003/2004 item #)</th>
<th>Outcome Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teacher experimentation</td>
<td>Scale</td>
</tr>
<tr>
<td>2</td>
<td>Teacher confidence in teaching writing</td>
<td>Scale</td>
</tr>
<tr>
<td>3</td>
<td>Pedagogical content knowledge of writing</td>
<td>Scale</td>
</tr>
<tr>
<td>4</td>
<td>I enjoy writing more (15a/14a)</td>
<td>Single item</td>
</tr>
<tr>
<td>5</td>
<td>I am a more confident writer (15c/14c)</td>
<td>Single item</td>
</tr>
<tr>
<td>6</td>
<td>I write more often (15d/14d)</td>
<td>Single item</td>
</tr>
</tbody>
</table>

Table 8.1. ECRW Outcome/Dependent Variables

We used 26 items as independent variables (see Table 8.2). Only one of these was a scale (the extensiveness of their professional development participation). The majority of the items that were used as independent variables were related to opportunities to learn or school culture.
<table>
<thead>
<tr>
<th>#</th>
<th>Description (2003/2004 item #)</th>
<th>Predictor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How much they have participated in pd</td>
<td>Scale</td>
</tr>
<tr>
<td>2</td>
<td>School-wide discussions of professional literature on teaching writing (8a/7a)</td>
<td>Single item</td>
</tr>
<tr>
<td>3</td>
<td>School or grade level meetings to discuss ECRW program elements (8b/7b)</td>
<td>Single item</td>
</tr>
<tr>
<td>4</td>
<td>Visiting other classrooms in my school (8c/7c)</td>
<td>Single item</td>
</tr>
<tr>
<td>5</td>
<td>Visiting classrooms in other schools (8d/7d)</td>
<td>Single item</td>
</tr>
<tr>
<td>6</td>
<td>Watching a coach or exemplary teacher model instruction (8e/7e)</td>
<td>Single item</td>
</tr>
<tr>
<td>7</td>
<td>Having a coach observe my teaching and provide feedback (8f/7f)</td>
<td>Single item</td>
</tr>
<tr>
<td>8</td>
<td>Having a coach study my students’ work and comment on ways I could improve their learning (8g/7g)</td>
<td>Single item</td>
</tr>
<tr>
<td>9</td>
<td>Informal discussions with colleagues about teaching writing (8h/7h)</td>
<td>Single item</td>
</tr>
<tr>
<td>10</td>
<td>Professional development on the teaching of writing held outside of my school (8i/7i)</td>
<td>Single item</td>
</tr>
<tr>
<td>11</td>
<td>Planning my writing curriculum (8j/7j)</td>
<td>Single item</td>
</tr>
<tr>
<td>12</td>
<td>Experimenting with components of ECRW (8k/7k)</td>
<td>Single item</td>
</tr>
<tr>
<td>13</td>
<td>Book talks with other adults (8l/7l)</td>
<td>Single item</td>
</tr>
<tr>
<td>14</td>
<td>Literacy team meetings (8m/7m)</td>
<td>Single item</td>
</tr>
<tr>
<td>15</td>
<td>ECRW Speaker Series (8n/7n)</td>
<td>Single item</td>
</tr>
<tr>
<td>16</td>
<td>Visits to ECRW demonstration teachers’ classrooms in my school (11a/9a)</td>
<td>Single item</td>
</tr>
<tr>
<td>17</td>
<td>Visits to ECRW demonstration teachers’ classrooms in other schools (11b/9b)</td>
<td>Single item</td>
</tr>
<tr>
<td>18</td>
<td>ECRW curriculum materials (11c/9c)</td>
<td>Single item</td>
</tr>
<tr>
<td>19</td>
<td>ECRW Speaker Series (11d/9d)</td>
<td>Single item</td>
</tr>
<tr>
<td>20</td>
<td>Principal’s leadership (11e/9e)</td>
<td>Single item</td>
</tr>
<tr>
<td>21</td>
<td>In-service workshops on ECRW (11f/9f)</td>
<td>Single item</td>
</tr>
<tr>
<td>22</td>
<td>Grade-level meetings focused on ECRW (11g/9g)</td>
<td>Single item</td>
</tr>
<tr>
<td>23</td>
<td>Informal conversations with other teachers related to ECRW (11h/9h)</td>
<td>Single item</td>
</tr>
<tr>
<td>24</td>
<td>Coaching support (17b/9l)</td>
<td>Single item</td>
</tr>
<tr>
<td>25</td>
<td>Professional reading material to provide context and background (17l/9n)</td>
<td>Single item</td>
</tr>
<tr>
<td>26</td>
<td>Opportunity to experiment with ECRW methods and design (17n/9o)</td>
<td>Single item</td>
</tr>
</tbody>
</table>

Table 8.2. ECRW Independent Variables

ECRW Regression Results

**Teacher experimentation.** Multiple regressions were conducted to determine which factors were good predictors of the degree to which teachers were inclined to experiment with their practice and learn from their classroom experience. For 2003, regression results indicated an overall model of seven meaningful predictors. These seven predictors significantly predict teacher experimentation ($R^2 = 0.23$, $F_{2,118} = 4.94$, $p < .001$). The predictors that were positively correlated with teacher willingness to experiment and learn from practice included having a coach observe one’s teaching, attending professional development outside of one’s home school, planning one’s curriculum, professional reading about ECRW, and visiting teachers’ classrooms in
other schools. Grade level meetings associated with ECRW had a negative correlation (see Table 8.3).

<table>
<thead>
<tr>
<th>Predictors</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having a coach observe my teaching and provide feedback</td>
<td>0.05</td>
<td>1.41</td>
<td>0.16</td>
</tr>
<tr>
<td>Professional development on teaching writing held outside of my school</td>
<td>0.06</td>
<td>1.57</td>
<td>0.12</td>
</tr>
<tr>
<td>Planning my writing curriculum</td>
<td>0.06</td>
<td>1.94</td>
<td>0.05</td>
</tr>
<tr>
<td>Visits to ECRW demonstration teachers' classrooms in other schools</td>
<td>0.06</td>
<td>1.69</td>
<td>0.09</td>
</tr>
<tr>
<td>ECRW curriculum materials</td>
<td>0.11</td>
<td>1.53</td>
<td>0.13</td>
</tr>
<tr>
<td>Grade-level meetings focused on ECRW</td>
<td>-0.08</td>
<td>-1.58</td>
<td>0.12</td>
</tr>
<tr>
<td>Professional reading material to provide context and background</td>
<td>0.19</td>
<td>3.51</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 8.3. 2003 Predictors of ECRW Teacher Experimentation

For 2004, six predictors were found ($R^2 = 0.12$, $F_{6,231} = 5.07$, $p < .001$). Predictors that were positively correlated included school and grade level meetings, having a coach observe one’s teaching, professional development outside of one’s school, visits to other teachers’ classrooms, and informal conversations with other teachers about ECRW. The opportunity to experiment with ECRW components in one’s classroom was negatively correlated (see Table 8.4).

<table>
<thead>
<tr>
<th>Predictors</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>School/grade level meetings</td>
<td>0.06</td>
<td>2.13</td>
<td>0.03</td>
</tr>
<tr>
<td>Having a coach observe my teaching</td>
<td>0.04</td>
<td>2.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Professional development outside of my school</td>
<td>0.04</td>
<td>2.10</td>
<td>0.04</td>
</tr>
<tr>
<td>Visits to ECRW demonstration teachers' classrooms in other schools</td>
<td>0.05</td>
<td>2.20</td>
<td>0.03</td>
</tr>
<tr>
<td>Informal conversations with other teachers related to ECRW</td>
<td>0.11</td>
<td>1.82</td>
<td>0.07</td>
</tr>
<tr>
<td>Opportunity to experiment with ECRW methods and design</td>
<td>-0.10</td>
<td>-2.15</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Table 8.4. 2004 Predictors of ECRW Teacher Experimentation

Teacher confidence. We also ran regressions to surface predictors of increased teacher confidence in teaching writing. In 2003, ten predictors ($R^2 = 0.38$, $F_{10,116} = 7.04$, $p < .001$) were identified. Among the variables that were positively correlated with increases in teacher confidence were the extensiveness of teachers’ participation in professional development, having a coach observe one’s teaching, book talks, literacy team meetings, the ECRW Speaker Series, professional reading, and the ECRW curriculum materials. Two variables had negative correlations: working with a coach on students’ work and the Induction Institute of 2001 (see Table 8.5).
Table 8.5. 2003 Predictors of ECRW Teacher Confidence in Teaching Writing

In 2004, we identified three predictors ($R^2 = 0.06, F_{3,233} = 4.80, p < .001$): Having a coach study one’s students’ work and book talks with other adults were positively correlated; planning one’s writing curriculum was negatively correlated (see Table 8.6).

<table>
<thead>
<tr>
<th>Predictors</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much they have participated in pd (scale)</td>
<td>0.12</td>
<td>1.61</td>
<td>0.11</td>
</tr>
<tr>
<td>School or grade level meetings to discuss ECRW program elements</td>
<td>-0.09</td>
<td>-2.20</td>
<td>0.03</td>
</tr>
<tr>
<td>Having a coach observe my teaching and provide feedback</td>
<td>0.16</td>
<td>3.28</td>
<td>0.00</td>
</tr>
<tr>
<td>Having a coach study my students’ work and comment on ways I could</td>
<td>-0.08</td>
<td>-1.58</td>
<td>0.12</td>
</tr>
<tr>
<td>Book talks with other adults</td>
<td>0.05</td>
<td>1.41</td>
<td>0.16</td>
</tr>
<tr>
<td>Literacy team meetings</td>
<td>0.08</td>
<td>2.77</td>
<td>0.01</td>
</tr>
<tr>
<td>ECRW Speaker Series</td>
<td>0.11</td>
<td>2.59</td>
<td>0.01</td>
</tr>
<tr>
<td>ECRW curriculum materials</td>
<td>0.20</td>
<td>2.56</td>
<td>0.01</td>
</tr>
<tr>
<td>The Induction Institute held in the summer of 2001</td>
<td>-0.09</td>
<td>-2.51</td>
<td>0.01</td>
</tr>
<tr>
<td>Professional reading material to provide context and background</td>
<td>0.15</td>
<td>2.34</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Table 8.6. 2004 Predictors of ECRW Teacher Confidence in Teaching Writing

If we step back and take stock for a moment, for three of these four results, there appear to be two patterns of note: working with a coach appears as a positive predictor three of the four times. Moreover, although the particular opportunities to learn that are positive (and negative) correlates vary, it appears that some mixture of opportunities to learn that are removed from and closer to practice is optimal for increases in teacher confidence and teacher willingness to experiment with/learn from practice. That is, teachers’ confidence and capacity increased when they participated in opportunities to learn like experimenting in their own classroom and working with a coach, while also attending Saturday seminars and summer institutes. Let us now consider the third scale that we created.

**Pedagogical content knowledge for writing.** In analyses of the 2003 survey results, the regression identified eight predictors of increases in teachers’ pedagogical content knowledge for writing ($R^2 = 0.3, F_{8,121} = 9.19, p < .001$). Positive correlates included the extensiveness of participants involvement in professional development, planning one’s curriculum, the Speaker Series, ECRW curriculum materials, detailed “how to” information, informal conversations with colleagues, and principal’s leadership. Again, the 2001 Summer Induction Institute was negatively correlated with reported increases in teachers’ pedagogical content knowledge (see Table 8.7).
The 2004 results were slightly different. The regression identified eight predictors ($R^2 = 0.25, F_{8,227} = 9.45, p < .001$). Again, the extensiveness of participants’ involvement in professional development, planning one’s writing curriculum, ECRW curriculum materials were positively correlated with increased pedagogical content knowledge. Other positive factors were having a coach study one’s students’ work, professional development outside of one’s school, the opportunity to experiment with ECRW materials and techniques in one’s classroom, and coaching support (see Table 8.8).

### Table 8.7. 2003 Predictors of ECRW Increased Pedagogical Content Knowledge for Writing

<table>
<thead>
<tr>
<th>Predictors</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much they have participated in pd (scale)</td>
<td>0.30</td>
<td>3.16</td>
<td>0.00</td>
</tr>
<tr>
<td>Planning my writing curriculum</td>
<td>0.19</td>
<td>3.94</td>
<td>0.00</td>
</tr>
<tr>
<td>ECRW Speaker Series</td>
<td>0.10</td>
<td>1.72</td>
<td>0.09</td>
</tr>
<tr>
<td>ECRW curriculum materials</td>
<td>0.32</td>
<td>3.02</td>
<td>0.00</td>
</tr>
<tr>
<td>Principal’s leadership</td>
<td>0.11</td>
<td>1.61</td>
<td>0.11</td>
</tr>
<tr>
<td>Informal conversations with other teachers related to ECRW</td>
<td>0.23</td>
<td>1.88</td>
<td>0.06</td>
</tr>
<tr>
<td>The Induction Institute held in the summer of 2001</td>
<td>-0.15</td>
<td>-2.95</td>
<td>0.00</td>
</tr>
<tr>
<td>Detailed &quot;how to&quot; information</td>
<td>0.12</td>
<td>1.60</td>
<td>0.11</td>
</tr>
</tbody>
</table>

### Table 8.8. 2004 Predictors of ECRW Increased Pedagogical Content Knowledge for Writing

<table>
<thead>
<tr>
<th>Predictors</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much they have participated in pd</td>
<td>0.12</td>
<td>2.17</td>
<td>0.03</td>
</tr>
<tr>
<td>Having a coach study my students’ work</td>
<td>0.06</td>
<td>1.70</td>
<td>0.09</td>
</tr>
<tr>
<td>Professional development outside of my school</td>
<td>0.09</td>
<td>2.76</td>
<td>0.01</td>
</tr>
<tr>
<td>Planning my writing curriculum</td>
<td>0.07</td>
<td>2.10</td>
<td>0.04</td>
</tr>
<tr>
<td>Visits to ECRW demonstration teachers’ classrooms in other schools</td>
<td>0.07</td>
<td>2.22</td>
<td>0.03</td>
</tr>
<tr>
<td>ECRW curriculum materials</td>
<td>0.14</td>
<td>2.57</td>
<td>0.01</td>
</tr>
<tr>
<td>Coaching support</td>
<td>0.07</td>
<td>1.99</td>
<td>0.05</td>
</tr>
<tr>
<td>Opportunity to experiment with ECRW methods and design</td>
<td>0.18</td>
<td>2.67</td>
<td>0.01</td>
</tr>
</tbody>
</table>

### Other analyses.
As previously mentioned, we also ran regressions on a handful of individual items that resonated with some of the lessons were learned from the field study. A regression on “I enjoy writing more” surfaced nine predictors ($R^2 = 0.33, F_{9,118} = 6.40, p < .001$). Visiting classes in other schools and demonstration teachers’ classes in other schools, literacy team meetings, having a coach observe one’s teaching, ECRW curriculum materials, the ECRW Speaker Series, and principal leadership were all positively correlated with increases in teachers’ enjoyment of writing (which might mean that they wrote more). School or grade level meetings were negatively correlated (see Table 8.9).
<table>
<thead>
<tr>
<th>Predictors</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>School or grade level meetings to discuss ECRW program elements</td>
<td>-0.24</td>
<td>-3.24</td>
<td>0.00</td>
</tr>
<tr>
<td>Visiting classrooms in other schools</td>
<td>0.15</td>
<td>2.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Having a coach observe my teaching and provide feedback</td>
<td>0.22</td>
<td>3.52</td>
<td>0.00</td>
</tr>
<tr>
<td>Literacy team meetings</td>
<td>0.10</td>
<td>2.11</td>
<td>0.04</td>
</tr>
<tr>
<td>ECRW Speaker Series</td>
<td>0.15</td>
<td>2.16</td>
<td>0.03</td>
</tr>
<tr>
<td>Visits to ECRW demonstration teachers' classrooms in other schools</td>
<td>0.11</td>
<td>1.51</td>
<td>0.13</td>
</tr>
<tr>
<td>ECRW curriculum materials</td>
<td>0.23</td>
<td>1.65</td>
<td>0.10</td>
</tr>
<tr>
<td>Principal's leadership</td>
<td>-0.19</td>
<td>-2.07</td>
<td>0.04</td>
</tr>
<tr>
<td>Professional reading material to provide context and background</td>
<td>0.33</td>
<td>3.02</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 8.9. 2003 Predictors of ECRW Participants’ Enjoyment of Writing

In 2004, the predictors were fewer. Book talks with other adults was positively correlated with increases in teacher enjoyment of writing; planning one’s writing curriculum and the ECRW Speaker Series was negatively correlated (see Table 9.10,

<table>
<thead>
<tr>
<th>Predictors</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning my writing curriculum</td>
<td>-0.14</td>
<td>-3.14</td>
<td>0.00</td>
</tr>
<tr>
<td>Book talks with other adults</td>
<td>0.07</td>
<td>1.71</td>
<td>0.09</td>
</tr>
<tr>
<td>ECRW Speaker Series</td>
<td>-0.08</td>
<td>-1.97</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Table 8.10. 2004 Predictors of ECRW Participants’ Enjoyment of Writing

We also examined the predictors of teachers’ self reported increased confidence as writers. For the 2003 survey, the regression identified eight predictors ($R^2 = 0.06$, $F_{37,234} = 5.37$, $p < .001$) for teachers’ responses to the prompt, “I am a more confident writer.” Factors that were positively correlated included having a coach observe one’s teaching, professional development held outside of one’s school, literacy team meetings, ECRW materials, and the Saturday Speakers Series (see Table 8.11). This makes sense, since the Saturday speakers often spoke to and of teachers as authors, and summer institutes included opportunities for teachers to write. Informal discussions with colleagues, principal’s leadership, and the Induction Institute of 2001 were all negatively correlated.
Predictors | b  | t   | p   
---|-----|-----|-----
Having a coach observe my teaching and provide feedback | 0.19 | 3.42 | 0.00
Informal discussions with colleagues on the teaching of writing | -0.13 | -1.82 | 0.07
Professional development on teaching writing held outside of my school | 0.16 | 2.48 | 0.01
Literacy team meetings | 0.08 | 1.91 | 0.06
ECRW curriculum materials | 0.20 | 1.71 | 0.09
ECRW Speaker Series | 0.12 | 1.97 | 0.05
Principal's leadership | -0.16 | -2.10 | 0.04
The Induction Institute held in the summer of 2001 | -0.16 | -2.72 | 0.01

Table 8.11. 2003 Predictors of ECRW Participants’ Confidence as Writers

In 2004, the factors that were positively correlated with teachers’ increased confidence as writers included visiting other classrooms in their own schools, visits to demonstration teachers’ classrooms in their own schools, informal discussions with colleagues, and ECRW curriculum materials. But professional development outside of my school, visits to demonstration teachers’ classrooms in other schools, grade level meetings focused on ECRW, and the opportunity to experiment with ECRW materials and methods were all negatively related to increased in teachers’ confidence ($R^2 = 0.13$, $F_{9,231} = 3.67$, $p < .001$) (see Table 8.12). This is the opposite of what we found in 2003; we return to these confusing results momentarily.

Predictors | b  | t   | p   
---|-----|-----|-----
Visiting other classrooms in my school | 0.10 | 1.74 | 0.08
Professional development outside of my school | -0.12 | -2.51 | 0.01
Planning my writing curriculum | -0.12 | -2.45 | 0.01
Visits to ECRW demonstration teachers' classrooms in my school | 0.14 | 2.80 | 0.01
Visits to ECRW demonstration teachers’ classrooms in other schools | -0.15 | -2.78 | 0.01
ECRW curriculum materials | 0.15 | 1.84 | 0.07
Grade-level meetings focused on ECRW | -0.19 | -2.57 | 0.01
Informal conversations with other teachers related to ECRW | 0.24 | 1.66 | 0.10
Opportunity to experiment with ECRW methods and design | -0.18 | -1.69 | 0.09

Table 8.12. 2004 Predictors of ECRW Participants’ Confidence as Writers

Finally, we looked for predictors of teachers’ reports that they write more often ($R^2 = 0.24$, $F_{8,120} = 4.80$, $p < .0010$. We identified eight factors that predicted increases in teachers actually writing. Visiting classrooms in other schools, having a coach observe one’s practice, book talks with other adults, literacy team meetings, professional reading, and the ECRW Speaker Series were all positively correlated with teachers writing (See Table 8.13). The 2001 summer Induction Institute and school/grade level meetings to discuss ECRW were negatively correlated.
Table 8.13. 2003 Predictors of Frequency of ECRW Participants Writing

<table>
<thead>
<tr>
<th>Predictors</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>8b. School or grade level meetings to discuss ECRW program elements</td>
<td>-0.14</td>
<td>-1.97</td>
<td>0.05</td>
</tr>
<tr>
<td>8d. Visiting classrooms in other schools</td>
<td>0.12</td>
<td>1.88</td>
<td>0.06</td>
</tr>
<tr>
<td>8f. Having a coach observe my teaching and provide feedback</td>
<td>0.17</td>
<td>2.85</td>
<td>0.01</td>
</tr>
<tr>
<td>8l. Book talks with other adults</td>
<td>0.11</td>
<td>2.18</td>
<td>0.03</td>
</tr>
<tr>
<td>8m. Literacy team meetings</td>
<td>0.07</td>
<td>1.54</td>
<td>0.13</td>
</tr>
<tr>
<td>8n. ECRW Speaker Series</td>
<td>0.11</td>
<td>1.67</td>
<td>0.10</td>
</tr>
<tr>
<td>11i. The Induction Institute held in the summer of 2001</td>
<td>-0.15</td>
<td>-2.33</td>
<td>0.02</td>
</tr>
<tr>
<td>17l. Professional reading material to provide context and background</td>
<td>0.20</td>
<td>2.00</td>
<td>0.05</td>
</tr>
</tbody>
</table>

For the 2004 survey responses, we identified four predictors ($R^2 = 0.06, F_{4, 235} = 3.90, p < 0.001$): visiting classrooms in one’s school, visiting classrooms in other schools, and book talks (see Table 8.14).

Table 8.14. 2004 Predictors of Frequency of ECRW Participants Writing

<table>
<thead>
<tr>
<th>Predictors</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visiting other classrooms in my school</td>
<td>0.11</td>
<td>1.78</td>
<td>0.08</td>
</tr>
<tr>
<td>Visiting classrooms in other schools</td>
<td>0.12</td>
<td>2.14</td>
<td>0.03</td>
</tr>
<tr>
<td>Professional development outside of my school</td>
<td>-0.11</td>
<td>-2.21</td>
<td>0.03</td>
</tr>
<tr>
<td>Book talks with other adults</td>
<td>0.08</td>
<td>1.71</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Given the vast array of opportunities to learn in ECRW and the fact that our case studies helped us understand the considerable variation within each opportunity, it is not really surprising that it is nearly impossible to find any common predictors for the indicants we used for teacher learning (increased experimentation, confidence, writing activity, etc.). But we do notice several trends: coaching matters (which we learned also in the field work for this research), as does visiting other teachers’ classrooms or demonstration teachers’ classrooms, ECRW curriculum materials, and the Saturday Speaker Series. These opportunities repeatedly turn up as predictors in the regressions that we ran. Beyond that, as we noted earlier, save for the constancy of having a coach observe one’s practice, the pattern that struck us most was that teachers learned more when they participated in a cluster of learning opportunities, some of which were located very close to practice (visitations, for example), others that were more removed (Speakers, professional development outside of one’s own school, book talks).

Finally, we were struck that this mix was slightly different than the results of the survey when we asked teachers what forms of professional development mattered the most. Recall that survey respondents judged informal discussions, ECRW materials, grade level meetings as the most helpful opportunities to learn, and found district level professional development somewhat helpful, and visits to demonstration teachers’ classrooms and the Speaker Series less helpful (see Table 6.3). The trend when asked was clearly in favor of opportunities to learn that were based in their schools and close to their classrooms. When we ran regressions, however, while ECRW materials were still the single most common predictor of increases in learning, confidence, and the like, book groups, Saturday Speakers, and visits outside of their schools were also regularly correlated with increase knowledge, confidence, and the like.
SVMI Independent and Dependent Variables

We developed two scales for the impact of SVMI based on survey responses: teacher confidence and teacher pedagogical content knowledge in mathematics (for details about these impact scales, see Wilson and Mapuranga, 2006), which paralleled two of the three scales we developed for ECRW. And as was the case with ECRW, we also ran regressions with a handful of individual items as well (see Table 8.15). The specific items that constitute each scale, and the scales’ item-score correlations and alpha reliabilities can be found in Appendix B.

Method. However, we found very little of interest in the regression analyses, and so we calculated Pearson correlations to assess the relationship between SVMI variables of interest. A Pearson correlation is a statistical measurement of the degree of relationship or association between two sets of numbers (variables) to describe how closely they track or are related to one another. The notion does not necessarily imply causation since no direction of influence is known or can be assumed.

Several authors have offered guidelines for the interpretation of a correlation coefficient. J. Cohen (1988), for example, has suggested the following interpretations for correlations in psychological research:

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Negative</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>-0.29 to -0.10</td>
<td>0.29 to 0.10</td>
</tr>
<tr>
<td>Medium</td>
<td>-0.49 to -0.30</td>
<td>0.49 to 0.30</td>
</tr>
<tr>
<td>Large</td>
<td>-0.50 to -1.00</td>
<td>0.50 to 1.00</td>
</tr>
</tbody>
</table>

Table 8.15. Suggested Interpretations for Correlations in Psychological Research (J. Cohen, 1988)

The outcomes of interest for these analyses included two scales – teacher immersion and pedagogical content knowledge – and three single items (confidence, increased understanding, and desire to learn more about mathematics and teaching mathematics) (see Table 8.16).

<table>
<thead>
<tr>
<th>Description</th>
<th>Outcome Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher engagement in and satisfaction with SVMI</td>
<td>Scale</td>
</tr>
<tr>
<td>Pedagogical content knowledge</td>
<td>Scale</td>
</tr>
<tr>
<td>I am a more confident mathematical thinker</td>
<td>Single item</td>
</tr>
<tr>
<td>Increased understanding the concepts/knowledge skills necessary to teach math</td>
<td>Single item</td>
</tr>
<tr>
<td>I want to learn more about mathematics and teaching math</td>
<td>Single item</td>
</tr>
</tbody>
</table>

Table 8.16 Dependent Variables for SVMI Analyses

The independent variables included both the breadth and depth of teachers participation in SVMI; the extensiveness of their work with a coach; the degree to which they experimented with ideas and materials in their own classrooms, the overall climate of their school; and principal support (see Table 8.17):
Unfortunately, we found very little of interest or surprise in the correlational analyses. We summarize briefly what we did find. On the matter of teacher engagement and satisfaction, in 2003, teachers who worked with coaches more extensively (0.33) and attended SVMI/MARS workshops (0.50) were more immersed or engaged with the professional development program. In 2004, teachers who participated in a broader set of experiences (0.29), depth of experiences (0.44), and had more extensive experiences with their coaches (0.38) reported higher degrees of engagement and satisfaction.

On the matter of pedagogical content knowledge, in 2003, teachers who participated more broadly (0.26) and more deeply (0.40) reported higher increases in their pedagogical content knowledge. In 2004, only breadth of experience was positively correlated with increased pedagogical content knowledge (0.22).

In terms of teachers' confidence, we found a positive correlation between participation in SVMI and MARS workshops (0.33) with increases in teachers confidence in 2003. In the 2004 analyses, we found positive relationships between the breadth of teachers' participation (0.21), depth (0.42), and extensiveness of work with a coach (0.27).

When we looked for correlations with increases in teachers understanding of the concepts and skills necessary to teach mathematics, in 2003, we found positive correlations with breadth (0.35) and depth (0.32) of participation. In the 2004 data, there were no strong associations with this item.

In 2003, teacher reports of increased interest in learning more about mathematics and teaching mathematics were positively correlated with the extensiveness of their work with a coach (0.39), attendance at workshops for SVMI/MARS (0.41), and principal support (0.26). In 2004, increased interest in learning more was positively correlated with the overall climate of the participants' school (0.24) and the support of the principal (0.25).

Overall, we were not able to learn much from the SVMI surveys. However, we do not here that breadth and depth of participation appear to be consistently positively related to a range of outcome variables, as does the extensiveness of a teachers interactions with a coach. Principal support and school climate did not appear as significantly related to most of the outcome measures we used.

---

Table 8.17 Independent Variables of Interest in SVMI Analyses

<table>
<thead>
<tr>
<th>Description</th>
<th>Predictor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breadth of participating in SVMI</td>
<td>Scale</td>
</tr>
<tr>
<td>Depth of participation in SVMI</td>
<td>Scale</td>
</tr>
<tr>
<td>Extensiveness of work with a coach</td>
<td>Scale</td>
</tr>
<tr>
<td>Learning in practice</td>
<td>Scale</td>
</tr>
<tr>
<td>Overall climate in your school</td>
<td>Scale</td>
</tr>
<tr>
<td>Principal support</td>
<td>Single item</td>
</tr>
</tbody>
</table>

36 Numbers in parentheses are the Pearson correlation coefficients. Refer to Table 8.15 for guidance as to how powerful these correlations are.
Summary

The survey analyses do not support confident claims about the effects of various components of SVMI or ECRW. This might be due to the quality of the survey instruments, or the data collected, issues that we have already mentioned. However, the lack of definitive results might also be due to the variability in “delivery” or program implementation that we documented in our field studies. While tracking teachers participation in both programs is important, the fact that participation can vary in its quality — the depth of a teacher’s engagement, or the abilities of a coach, or the range of activities that a teacher engages in his or her coach, for example — makes us wary of the power of blunt measures like participation to accurately assess the effects of professional development programs on teacher participants.
Most PD opportunities remain fragmented, poorly aligned with curricula, and inadequate to meet teachers' needs... for deeper knowledge of subject matter and understanding of pedagogy (Cohen & Hill, 2001; Corcoran & McDiarmid, 2000). Often the content of existing PD programs is unconnected to teachers' daily work, and little follow-up support is offered. (Weiss & Pasely, 2006, p. 1)

Most teachers do not participate in content-intense professional development. (Garet, Porter, Desimone, Birman, & Yoon, 2001)

Although we live in an age of calls for a new kind of professional development, most teachers still experience traditional programs: half day seminars, incoherent calendars of available “experts”; sessions with “teacher-leaders” who have just come back from a new professional development experience themselves; workshops with publishers about a newly adopted curriculum. That SVMI and ECRW reach so many teachers, albeit in diverse ways, is noteworthy. And given the fact that policymakers and educators continue to press for professional development programs that are long-term, coherent, content-rich, and focused (but with insufficient empirical evidence on their content or effects), it seems important to document these two programs, and what it takes to create and sustain them. This was one central aim of this report.

In addition, our aim was to document what teachers learned, and the circumstances that shaped that learning. In concluding the report, we summarize our findings and lessons learned.

**Teachers Learn**

Across both programs, and across the case studies and surveys, teachers report that they learn. We identified three patterns in those reports: (1) shifts in teachers' understanding of teaching as a practice, as well as their classroom behaviors; (2) changes in their subject matter knowledge, including their understanding of the “what” and “how” of mathematics and writing; and (3) an expansion of teachers' conceptions of teaching as a profession and its attendant obligations. In particular, they acquired confidence in their ability to write and to do mathematics and confidence in their ability to teach those subject matters. That confidence was grounded in changes in their understanding of the activities of doing math and of writing. They became much more familiar with how one sets and explores mathematical problems; they were immersed in activities that require them to write. They were exposed to a range of new materials and new practices: genre studies and mini lessons, Singapore boxes and questioning strategies. These results resonate with other research on professional development (e.g., Desimone, Porter, Garet, Yoon, and Birman; 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001; Greenleaf and Schoenbach, 2001). Indeed, as Greenleaf and Schoenbach (2001) note about a content-rich reading professional development program:

Teachers benefit from opportunities to experience conceptual and academic domains as learners; in particular, to develop a generative theory of reading literacy, teachers benefit from experiencing difficulties posed by specific texts and literacy tasks as readers themselves. Traditional pedagogies of teacher professional development transmit ideas and conceptions stemming from research about reading to teachers in a delivery mode, focusing much of the professional time on specific instructional techniques. These traditional pedagogies may
build declarative knowledge . . . However, remaining as they do on the outside of reading
and merely referring to reading activity rather than taking place within or alongside
reading activity, these traditional methods cannot build the kind of situated and generative
understandings of the domain that can guide the moment by moment actions teachers take in
the classroom. Rather, the repeated opportunities to experience and articulate the experience
of reading -- the concepts and linguistic labels deriving from the work of reading
researchers -- but also the ability to draw on their own and their peers' procedural
knowledge, or know how, when approaching texts and literacy tasks with their students. (p. 22)

We agree. But such exhortations about the kinds of learning opportunities that
teachers need still rest on shaky empirical and conceptual grounds. Thus we caution
against researchers or professional development leaders assuming that “content-rich”
opportunities to learn necessarily lead to increased content knowledge and/or teaching
skill. Teachers take many lessons from engaging with content – about students and their
learning, about teaching and its challenges, about materials that might motivate and excite. They might become more engaged, more open, more confident. These are
important lessons for educators, and we do not dismiss them, for there are many things
that teachers need to know and feel able and willing to do.

The Depth and Extensiveness of Teacher Learning Varied

Not surprisingly, however, what and how much teachers learned varied. It
depended on teacher-specific variables: the depth and breadth of teachers’ experiences
within the programs; their entering knowledge and beliefs; and their enthusiasms,
appetite, and openness to new ideas. It also depended on school- and district-specific
variables: policy pressures (most notably accountability and curricular policies); school
leadership; and school culture. And finally, we have some reason to believe that what
teachers learned sometimes depended on program-specific variables: the experience and
competence of the coaches; the content and character of the summer institutes; the
meaningfulness of materials and tools offered to staff and participants; the coherence of
the offerings. However, because each program was actively engaged in “continual
improvement,” we could not collect systematic and longitudinal data on these shifting
resources.

These variables help us elaborate Cohen, Raudenbush, and Ball’s (2003) framework
of personal, conventional, and social/environmental resources (see Table 9.1):

<table>
<thead>
<tr>
<th>Personal Resources</th>
<th>Social/environmental Resources</th>
<th>Material Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher engagement</td>
<td>Leadership (principal and other teachers)</td>
<td>Funding for coaches</td>
</tr>
<tr>
<td>Teacher knowledge</td>
<td>School culture</td>
<td>Curriculum materials</td>
</tr>
<tr>
<td>Teacher belief</td>
<td>Social capital (networks of likeninded colleagues)</td>
<td>Teacher support materials</td>
</tr>
<tr>
<td>Teacher appetite for learning</td>
<td>Students</td>
<td>(Tools for Teachers, for instance)</td>
</tr>
<tr>
<td>Teacher confidence</td>
<td>Policy environment (accountability, standards-based reform, etc)</td>
<td>Coach support materials (WWIS, for example)</td>
</tr>
</tbody>
</table>

Table 9.1 Personal, Social, and Material Resources that Contribute to Teacher Learning

Professional development like that offered by SVMI and ECRW provides an array
of personal, social, and material resources. For instance, the professional development
can enhance teacher engagement or knowledge (personal resources); enhance
connections and collaborations with other teachers (social capital or environmental
resources); and enhance access to curriculum and other materials that teachers and coaches can use in their practice (material resources).

Despite the variability that we observed in relationship to the distribution and influence of these various resources, we do want to make two observations about recurrent patterns that we observed in teachers’ learning.

**Coaching matters.** But in the analyses of survey data and in our observations of the case study teachers, it was clear that competent, steady coaching helped teachers change their practices. We are less sure that it helped teachers acquire more content knowledge, but it was clear that having a coach to provide resources, raise questions about one’s choices, and work on the concrete details of how to take an idea from a professional development session and turn it into a workable classroom practice mattered to the participants.

It was also clear that this is the most expensive – both in terms of time and financial resources – aspect of both programs. Both programs, intentionally or not, ended up focusing those resources on teachers who were “novices” to ECRW and SVMI. Thus, other teachers did not get coached for nearly as long as they needed. More often than not, as soon as a teacher seemed reasonably confident in mastering the “basics” of ECRW and SVMI, coaches moved their attention to new participants who were “beginners.”

This meant, unfortunately, that most of the resources of each program were aimed at the “floor” of teacher learning and not the “ceiling.” The form this most often took in classrooms was that teachers began using materials and instructional strategies, but in thin or superficial ways. We do not mean here that they were being superficial; one’s early attempts at a practice often entail adopting the surface features of the practice.

Deeper understanding of the practice takes more time and experience. “Go deep” teachers and coaches in ECRW and an elite group of coaches and lead teachers in SVMI worked on continuing to deepen their understanding of the practices associated with each program. But in times of shrinking resources, attention remained largely on novices, not on the learning needs of participants whose development was more advanced.

Both programs also struggled with the resources necessary to support coach development. The coaches needed to learn how to coach, and like the ECRW and SVMI participants, once they acclimated to the new role, they also needed support to deepen and strengthen their coaching knowledge and practices. But channeling resources into those activities meant stealing them from other parts of the programs.

In sum, we found – not surprisingly – that teachers who worked with coaches learned more, and that learning more included learning more about what one did not know. This then led to a sense among both teachers and coaches that there was beneficial work to do for years to come. But limited resources often truncated those possibilities for continued growth in the company of colleagues. It also truncated what we were able to learn about the nature of teacher learning among very accomplished teachers. Linda Foster sensed this need when she created the study group for experienced coaches and teacher leaders. Similarly, ECRW staff asked coaches to revert to the “go deep” model of working with one teacher for a longer period of time near the end of our research. Unfortunately, it was not within our research design to study the

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37 Since coaching was an opportunity to learn that was negotiated with a school principal, neither program had control over how coaches and teachers were paired with one another, or for how long.

38 This is one of the weaknesses of large-scale studies of the effects of professional development. When teachers report that they have changed their practices, one does not know if those changes are on the surface or deeper.

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effects of these new developments on participants. Or to contrast the needs of teacher-participants in that setting with the needs of participants who were much less familiar with SVMI’s core tenets, materials, and ideas.

**Mixing it up matters.** Our second observation is that the teachers who participated, over time, in a mixture of learning opportunities learned more. This included opportunities to learn that looked a lot like traditional in-service, including sessions with outside experts and orientations to new curricular materials. Thus, in embracing a new reform paradigm for professional development, neither SVMI nor ECRW rejected outright the elements of the old paradigm. Our research suggests that the problem with traditional professional development programs is not that any individual component lacks value, or that professional development should not be offered separate from a teacher’s school and daily practice. Rather, those traditional practices (experts, one day workshops, and the like) lack the connective tissue to link them effectively with practice-based learning. Alone, they are not powerful enough interventions, for any one kind of support or resource is but “one perturbation to the status quo” (Davis & Krajcik, 2005, p. 8). This finding corresponds to Dewey’s observation that “the trouble with traditional education was not that it emphasized the external conditions that enter into the control of the experiences but that it paid so little attention to the internal factors which also decide what kind of experience is had” (p. 42).

This is why it is important for professional development programs like ECRW and SVMI to “go to school,” for following teachers into their schools, helped the staff make connections between the external and internal, the abstract ideas and the practical realities. The WWIS serves as a nice example here: Early in ECRW, the coaches were struggling with vague ideas about what ECRW teaching “should” look like compared to what they were witnessing in classrooms. And so Sally Hampton took a stab at creating a rubric that captured the characteristics of “idealized” ECRW practice – what students should be doing; how teachers would be acting, what materials would be present and how they would be used, and the like. The WWIS, thus, was a practical instrument that was developed for coaches when it became clear that the abstract ideas that they embraced in summer institutes and coaching sessions were insufficient for helping coaches understand, or even describe, what they saw (or did not see) in classrooms. The checklist was then constantly revised and reworked among coaches, with Sally, and then with Audrey Poppers. That tool, as well as others – the Toolkit for Teachers, the Mathematics Teaching Rubric – are artifacts that represented the bridging of external and internal, the dialectic between theory (the Noyce way) and practice.

Our findings thus do not diminish the importance of outside expertise; rather, they emphasize the need for strong, logical connections between external ideas and local contexts. So, for example, ECRW coaches repeatedly took the books that had been written by outside experts who spoke at summer institutes and Saturday Speakers Series and helped teachers apply the activities and ideas in those books in new or novel contexts.

**The Conceptual Complexity of Teacher Learning**

By connecting this “external knowledge” with teachers’ local, internal experiences, they embraced Dewey’s (1938) concepts of continuity and interaction, through which “knowledge and skill in one situation becomes an instrument of understanding and dealing effectively with the situations that follow” (p. 44). Ideas from summer institutes and Saturday sessions and Math Network meetings helped teachers participate or act in their classrooms in new ways. Absent such opportunities for adaptation – both of the teacher to the program and the program to the teacher – “the process of teaching and learning [is] accidental” (Dewey, 1938, p. 45). By creating social networks of colleagues, and on-going opportunities to learn both in their schools and outside,
ECRW and SVMI staff increased the chances that teacher learning was intentional and planned, not serendipitous and inadvertent.\(^\text{39}\) The “crisscrossing” of opportunities to learn reminded us of cognitive flexibility theory, as described by Rand Spiro and his colleagues (Spiro, Coulson, Feltovich, & Anderson, 1988; Spiro, Feltovich, Jacobson, & Coulson, 1991, 1992). This theory posits that in domains that are “ill-structured” and complex (like teaching), learners (here the learners are teachers) must "crisscross" the domain knowledge by comparing and contrasting information gained from different perspectives and themes pertinent to the domain. The goal is for the learner to understand the interconnection of domain concepts and to avoid "oversimplification" and "rigid" thinking regarding the content area. In other words, learners must be flexible in their understanding of a topic to apply important concepts. (Godshalk, Harvey, & Moller, 2004, p. 510)

According to this theory, in ill-structured domains, one needs to help learners develop a mindset for complexity, an adaptive flexibility, and the capacity to perceive in deeper and more nuanced ways. Using these ideas, one way to interpret the portfolio of opportunities to learn offered by SVMI and ECRW is that the sprawling opportunities -- and their strategic interactions -- created crisscrossing paths for teachers to take, which in turn helped the teacher-participants see ideas from new perspectives, all the while developing a "flexible" or "generous" understanding of those ideas and practices.

There are, of course, other theoretical perspectives that might help explain the effects of such professional development. For instance, activity theory has been used by some researchers to explain teacher learning (e.g., Grossman, Smagorinsky, & Valencia, 1999; Lave, 1996). Activity theory appeals to these scholars, we presume, because professional development programs co-exist with other “activity settings” – classrooms, schools, informal networks, professional meetings – and understanding how and when teachers learn might involve understanding more about the ecology, norms, tools, and discourses of those various learning communities. Still others have proposed alternative conceptions of “interconnected professional growth,” mapping out teachers’ pathways through various activities (Clarke & Hollingshead, 2002).

But there is no way to avoid the obvious: The results from our case studies of teacher learning are equivocal. Some teachers learn more, some learn less, some factors seem important, but they lack a predictive power since they are not always important. The survey results, even though they are only exploratory, are similarly equivocal: Some professional development seems to matter to some people, some times. Partly these less-than-satisfying results are due to limitations of our research, both in terms of design and instrumentation. But partly the results are due to complexities entailed in professional development – and what and when teachers learn from professional development -- which then leads to challenges for scholars and policymakers who wish definitive answers to questions about what teachers learn from professional development. Here we focus on several features of the conceptual complexity. We will consider the complexities of research momentarily.

First there is the matter of the breadth of teachers’ participation. Teachers’ “pathways” through both of these professional development opportunities varied both in terms of intensity and breadth. In ECRW, teachers had more or less coaching, \(^\text{39}\) There is also the issue that some activities engaged teachers more “actively” in the learning. Desimone, Porter, Garet, Yoon, and Birman (2002) found that “active learning opportunities” increased the effect of professional development on teachers’ practice. We are less sanguine about what constitutes an “active” learning opportunity since so many of the opportunities to learn that we observed actively engaged teachers’ minds, even as the participants listened to outside experts. Nonetheless, it is probably important to keep in mind that some of these opportunities to learn more actively engaged teachers in the discussions, materials use and development, and the like.

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participated in more or less professional development after the initial summer induction experience, and used the curricular materials more or less often or well. In SVMI, teachers participated (or not) in summer institutes, Math Network meetings, coaching, assessment scoring. Understanding the programs’ impact on individual teachers, in part, requires having a sense of the breadth and depth of their involvement in components. But it also requires, as we have pointed out, understanding how and when teachers learn from the interactions and intersections of various opportunities to learn.

It would probably be methodologically, empirically, and conceptually impossible to disentangle the relative effect of any single component given the almost infinite number of ways that one teacher can combine these various opportunities together in his or her own chosen pathway through ECRW or SVMI. This suggests that, theoretically, we still have some work to do on understanding “how” such programs work, what the dynamic between various opportunities to learn is, and how to optimize the opportunities for change and growth as a result of those dynamics.

A second complexity relates to the within program variability. Coaching is the most obvious example here. We saw teachers do many different things with their coaches. Coaches provided teachers with resources, they engaged in cycles of coaching with teachers, they supported reading groups at their schools, they co-planned and co-taught lessons, modeled lessons, organized and facilitated opportunities to look at student work, advised teachers on new policies, taught teachers about content, provided moral support, and helped teachers set up their classrooms and classroom routines. Thus, both the content of the conversations between coaches and teachers varied, as did the instructional strategies that coaches used. Coaching was not the only component that showed such variability. Not all lesson study experiences in SVMI were comparable in content and character; ECRW summer institutes and Saturday workshops varied in what teachers did and the content they interacted with.

A third complexity concerns the depth, intensity, and/or quality of a teachers’ engagement. Some teachers met with a coach once a year, others repeatedly. Some coaches were more experienced and/or knowledgeable (about content, teaching, and teacher learning). This led to experiences that were qualitatively different for individual participants. Similarly, some teachers attended the ECRW institutes every summer, deepening their engagement with and understanding of the curriculum, the assessments, and the ideas underlying the reform. Other teachers participated minimally, going to the required events but not necessarily intellectually or personally engaging with the material in an on-going way. This highlights the importance of measuring not only teacher participation in professional development, but the depth of that participation. As all teachers know, attendance is not equivalent to learning or engagement. If Shulman (2002) is right, and engagement is a crucial precursor for learning and understanding, then developing a graduated measurement of teachers’ engagement will matter when trying to model and measure the effects of professional development.

A fourth complexity was the program churn. Both programs changed substantially over the time that we conducted this research. Thus, the “treatment” varied each year, due to the individual appetites and motivations of participants, what was offered by Noyce, and financial constraints. Again, coaching offers perhaps the clearest example of this churn. Over the life of this research project, staff in both SVMI and ECRW worked to better articulate and elaborate the role and character of coaching in the programs; there was considerable change in how coaches coached and how they were supported in their coaching. By 2005, for example, ECRW was offering both advanced content seminars for coaches and staff development leaders on strategies for teaching narrative, strategies for conferencing that would enhance student engagement, and explorations of alternative coaching models. It was also offering coaching seminars, and a professional development institute for advanced training of coaches, staff developers, and teacher leaders.
There was similar churning in how coaching was understood in SVMI. When we first started the project, Joanne Rossi Becker (2001) had completed a study of classroom coaching for the Foundation. She interviewed and observed six coaches who had worked with SVMI and SCVMP, as well as 14 teachers who those coaches worked with. She identified three patterns in the coaches' interactions with their teachers: coach as collaborator, model, and leader. The coaches who were collaborators were much less directive than the coach who was the model and those who were identified as leaders. All of the coaches had a clear vision of mathematics instruction, and each worked to establish a shared vision of mathematics teaching with their teachers. While we did not consider this scholarship empirically strong, the program staff found those distinctions conceptually and pragmatically helpful and used them to guide the development of an image of coaching, along with an explication of the various roles and responsibilities of coaches. SVMI staff also developed the classroom observation guide which we have already described to help train the coaches' attention, and drew on the writing of other educators in hammering out the program's view of coaching (see, for example, West & Staub, 2003). Gradually, SVMI staff (SVMI, 2004) alit on the concept of "pedagogical content coaching," a process by which coaches help teachers both deepen their knowledge of mathematics and their knowledge of student thinking about those concepts, in addition to helping teachers develop instructional strategies to support student learning of those concepts. If professional development programs are vital and healthy — this churning is essential — but any model of the effects of professional development on teacher learning would have to acknowledge that churn, for it can threaten the validity of the research.

Of course, some of the churn had to do with shifting resources. Both programs were originally conceptualized as temporary interventions by a third party (the Noyce Foundation). School districts were to use the resources available at the time to build both the infrastructure and the capacity — the full range of resources mentioned above — to sustain the reforms after the Noyce financial support was withdrawn. But the Noyce funds were not the only resources that were shrinking. In fall 2003, California ranked next-to-last in total school staff to students; and throughout the study, California was well below the average of expenditures per pupil with the amount dropping each year of the study (http://www.edsource.org/edu_fin.cfm).

A fifth complexity is due to interactions. There are several relevant interactions here. For one, as we have pointed out, teachers who bring more knowledge and skill, as well as more energy and enthusiasm, appear to take more from the programs. There is, however, another kind of interaction, one that involves the combination of opportunities to learn. We have observed that teachers who participate, for instance, in both professional development located in their schools and professional development that pulls them away from their practice report to learn more (Halladay, Wilson, Duffy, & Mapuranga, 2006). As one ECRW teacher put it: "What I know now leads me to find better resources . . . I am making connections that I did not make before."

But it is not simply an interaction among formal opportunities to learn that shapes teacher learning. Our field studies suggest also that what teachers take from SVMI and ECRW is profoundly shaped by what they chose to do in their classrooms. Ball and Cohen (1999) have made the observation that, while we have attended to the question of what teachers learn from teacher education or in-service or professional development programs, we have not thoroughly considered the fact that teachers spend the majority of their time in classrooms, and it is in and from practice that they might learn a great deal. As one ECRW teacher put it: “My powerful learning occurs through mistakes and learning from them.” Other researchers have found similar results. Smylie (1989), for example, found that teachers ranked in-service last out of 14 possible opportunities for learning. Teachers ranked "direct classroom experience" as most important (p. 354).
While it seems obvious what this means – that experience is the best teacher – we are not so sure. Taking our lead from Dewey (1938), we see teacher learning from experience as being a thornier conceptual problem. Left to their own devices, with no help in “seeing” what is happening in their classrooms, teachers might feel that they are learning, but that learning may be limited and limiting. This is one of the reasons current “best practices” of professional development suggest that programs must be long term, with opportunities to experiment with new ideas in one’s own classroom and opportunities to reflect on those experiences built in. It is not so much that direct experience is a good teacher. Instead, this research has demonstrated to us that it is direct experience that has been intentionally, strategically focused and supported (with coaches and ideas and materials), nested within a longer, broader, sustained professional conversation (with peers in the faculty room, other teachers at Saturday sessions and summer institutes, and coaches) that is the good teacher. We are not arguing here that it was the teachers who had coaches who learned to see their classrooms and their students in new light. Certainly coaches often helped. But Saturday Speakers and Math Network meetings, materials developed for the coaches and teachers, these resources also helped teachers see their content, their classrooms, and their students in new ways. The Tools for Teachers is a good example here: Teachers knew how their students did on the MARS assessments, but by analyzing students’ responses, Linda Fisher and the coaches who worked with her created a document that helped the teachers identify patterns in student responses. Thus raw experience was turned into helpful materials for professional learning.

A critical component of whether or not that direct experience helps involves attending to the teachers’ students. Just as teachers are critical to student learning, students are equally critical to teacher learning. Many scholars, in fact, have documented the ways in which students are active “bargainers” in what happens in school (e.g., Cusick, 1983; McNeil, 1988; Sedlak, Wheeler, Pullin, & Cusick, 1986). Both ECRW and SVMI require that teachers listen to students much more, that is, the programs ask that both teachers act differently and that their students act differently. Learning to listen to students means providing spaces for students to talk, to present their ideas, to participate in class discussions, to explain their reasoning. Students are not puppets, however. In fact, they have clear and strong ideas about what school is like and what they should do; asked to talk more or to change their behavior, they can and do actively resist such requests, or fundamentally transform the teacher’s practice into something more mutually co-created. Hence, what teachers might learn from their practice is influenced both by the external factors that we have discussed in this report – prior knowledge and experience, principal support and social capital, materials, and opportunities to learn offered by the professional development programs – and by the circumstances of their classrooms. For instance, teachers who tried out the ideas they encountered in SVMI and ECRW were often surprised at what their students could do. Skeptical of the new materials and ideas, yet willing to see what happened, teachers found their students more articulate, interested, and able to write and to solve math problems and discuss their reasoning in class. In many of those classrooms, teachers were energized by these experiences, and motivated to press onward in their learning. They learned from those experiences details of practice – what a “good” question about fractions was, how to direct a student’s attention to a particular aspect of her writing, how to multitask during writer’s workshop, and the like. Working on the abstract ideas that they encountered in workshops and institutes, teachers became critical consumers of those ideas through their direct experience with those ideas in their classrooms: They had specific, concrete questions about the practices associated with using the materials, and spoke about those ideas from their experience, not just out of sheer commitment.

Yet there were also teachers whose students were not as responsive. For these teachers, trying out SVMI or ECRW felt like launching a lead balloon in the classroom: It fell dead to the floor, leading to no new interactions between teachers and students. For these teachers, classrooms were sites for professional learning, but mainly teachers

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learned about failure, not about the internal workings of the instructional strategies or the curricular materials. These experiences, in turn, sometimes shaped how teachers interacted in other professional development settings: lesson study groups, summer institutes, Saturday sessions and the like. Another way to think about this is that, just as the programs churn, so do schools and classrooms, and this school-based churning was an important factor in understanding what and when teachers learned.

Where do these complexities lead us? We began the study with a generic conceptual framework for how and what teachers might learn through professional development, given our limited knowledge of both professional development programs. Our map was similar to those proposed by others (e.g., Borko, 2004; Clarke & Hollingsworth, 2002; Fishman, Marx, Best, & Tal, 2003). In this sense, the study was an exploratory investigation of what teachers learned in ECRW and SVMI. However, one of the advantages of a field study is that it allows one to develop much more elaborated theories, and our work has been no exception. We leave this study with a much clearer sense of the factors (including resources) that shape teacher learning in and from these two professional development programs (see Table 9.1). And we propose that researchers in the future consider the following factors when designing research to track the effects of professional development on teacher and student learning.

If one were to model the effects of professional development, one would need to include teacher characteristics, program characteristics, school and student characteristics and student outcomes (see Figure 9.1).
In particular here we aim to capture the sense that each professional development program is a whole, not simply a set of separate components that can (or should) be disentangled. Instead, this research helped us appreciate how individual opportunities to learn mutually inform and reinforce one another. As Greenleaf and Schoenbach (2001) note:

*To develop a rich and generative repertoire of classroom practice, teachers need access to experientially-rich demonstrations of specific teaching approaches, with opportunities to make connections between these approaches and their own understandings of the domain, of student learning, and of their own teaching goals and approaches. They need access to one another, to a professional dialogue about teaching and classroom lesson design that is linked to a broader enterprise, such as helping all students develop as readers, which sets a purpose and goal for their investigation of new practices. They need encouragement to take risks and experiment in the classroom, to approach their own teaching practice and the teaching practice of their peers as an inquiry into instructional purposes, actions, and outcomes. To approach teaching as an inquiry, they need guided practice and the collegial support of their peers to plan, carry out, and reflect on classroom teaching.* (p. 23)

Again, like so much of the rhetoric of today’s policy and practice of professional development, we too see the need to provide a portfolio of opportunities to learn. And while we have increased clarity on the factors that enable and obstruct teacher learning (principal leadership and school culture, for example, or quality of the professional development), we leave this project wishing for more conceptual clarity about the inner workings of such programs.

The Complexity of Conducting Research on Teacher Learning

*Evaluating the impact of professional development is more complex than evaluating the effectiveness of a new drug or medical treatment. There are more intervening steps.* (P. Noyce, 2006)

This leads us to the lessons learned that we will take into our future research. Ours was a modest enterprise, and the research was conducted at a time of transition in terms of understanding the instruments we need to assess what teachers learn in professional development. If we were to propose such a project again, we would

* articulate a conceptually clear, and measurable set of variables;
* make a heavier investment in the develop of reliable instruments for measuring teacher knowledge and skill;
* develop a reliable indicator of teacher implementation of the program’s ideas and/or of teachers’ instruction;
* develop reliable measures of teachers’ engagement, that is, the breadth and depth of their participation in a professional development program;
* use methods that allow for a multivariate analysis that do not presume hierarchical relationships among variables; and
* separate the research from the Noyce Foundation staff more clearly.40

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40 Pendred Noyce (2006) nominates her own list of qualities and conditions for research on professional development, including “demonstrating that the target intervention works in the best of circumstances; selecting a stable assessment regimen for pre- and post-testing of the larger student group; assigning treatment and control groups prospectively; keeping careful records of teacher participation; linking student records to teacher records; thinking carefully about time frame; measuring student gains vs. control students, vs. historical controls; and monitoring change in teacher knowledge and action.” Our list, while resonating with this list differs slightly.
Variables. Let us begin with the variables of interest, which include teacher, school, and program characteristics. Teacher characteristics would have to include background knowledge, both pedagogical and subject matter; teaching experience; motivation to or appetite for learning. The model would then have to account for a web of professional development opportunities. We would argue that the teacher’s own classroom and classroom experience should be the center of that web. Variables that would need to be included would be the breadth of participation and depth, and analyses might examine the interactions among those opportunities.

But teacher learning does not take place in a vacuum, and so the model would need to account for the school in which teachers are both encountering and trying out those ideas. Among the characteristics that matter here would be social capital (the community of teachers within the school, as well as the connections of the teacher to a larger community of engaged teachers); principal leadership; school characteristics like class size, facilities, other professional development and teacher support; student and environment characteristics like those included in models that attempt to measure the effects of alternative pathways into teaching, say, student ability and motivation, family, neighborhood. The model would then also have to include factors concerning the policy environment, including accountability, curricular, and teacher quality policies; as well as robust measures of student outcomes.

Reliable, robust measures. Of particular importance to future research would be the development of robust measures of teacher knowledge and skill. Considerable investment has been made in the development of such measures by the Study of Instructional Improvement (e.g., Hill, Rowan, & Ball, 2005; Hill, Schilling, & Ball, 2004; Rowan & Ball, 2004). Because some aspects of teacher knowledge appear to be domain-specific, these assessments require the generation of 100s of items that are then used to create scales. If one considers the content areas of mathematics and reading and science and social studies, and the grade levels of preK-12, the development costs explode. But the quality of future research on the effects of teacher education, as well as induction and professional development programs on what teachers learn and can do depends on such development work.

As we have described here, the professional development staff realized that they needed data on the “implementation level” of teachers if they were to make sense of the student learning data. Their question was a relatively simple one: Is their variation in student achievement based on how thoroughly individual teachers embraced the reforms? In the case of ECRW, they found some evidence that this was the case. In SVMI, they found higher student achievement in a school that had received more sustained and more elaborate support. In studies that intend to illuminate the effects of professional development on teachers (perhaps in addition to, but separately from the students), researchers will need measures of implementation. These measures of implementation might also be understood as measures of instruction.

41 See www.teacherpolicyresearch.org/TeacherPathwaysProject.
42 Heather Hill (personal communication) estimates the development costs for the modest number of items that currently exist to be between five and seven million dollars, which includes seven years investment in both piloting the items and their validation.
43 One problem with the large-scale research that has been done on professional development is that “implementation” is often conceptualized as a dichotomous variable: one either uses the ideas/materials of the program or one doesn’t. But our research suggests that teasing out the effects of professional development will require more refined measures of “surface” adoption to “deep,” as well as the comprehensiveness (a teacher who uses bits and pieces of the program to teachers who adopt the full “package”) of implementation. Throughout the research, we often struggled with issues of “fidelity” of implementation, which Mowbray, Holter, Teague, and Bybee (2003) define as “the extent to which delivery of an intervention adheres to the protocol or program model originally developed. In the end, we chose not to use that language in
experiences of the SII study shed light on the resources needed and the complexity of developing such instrumentation. Rowan and Ball (2004) enumerate some of the associated challenges, which range from sampling (What about teaching should be documented? How often?) to the validity and discriminatory power of the instrumentation to the problems of developing measures of teaching when there are multiple views of what constitutes good teaching. Other challenges involve the lack of an agreed upon vocabulary of teaching, which means that it is difficult to know whether teachers and researchers share the same understanding of particular concepts: small group work, direct instruction, critical thinking, problem solving, discussion. Whether one uses surveys, observations, or interviews to collect data, one depends upon shared language.

Because SVMI and ECRW staff were working with a small group of coaches as they developed their implementation scales and evaluation rubrics, they were able to invest in and then count on some shared understanding of terms. But scaling up from these enterprises and using those measures (or any other that might be developed) would entail more work before such measures were valid, reliable, and “transportable” to other contexts. We offer one example: Both the WWIS and the Mathematics Teaching Rubric are based on the relevant program’s ideological beliefs about the content and character of instruction. But to be used by other programs, or to be used in research to measure instruction, such instruments would have to be subjected to critique concerning the validity of those viewpoints. This, of course, was not the purpose of either instrument, so we do not mean to suggest otherwise. We only mean to use those existing instruments as examples of what more it would take to develop responsible measures for future research.44

Because we found that the breadth and depth of a teacher’s participation in ECRW and SVMI seemed to matter to their learning, we would also want to develop a robust measure of teacher engagement. Shulman (2002) has recently argued that engagement is an essential aspect of learning, the first step in developing the kind of understanding that one can then act on and reflect upon. We would want to test this hypothesis in future research on teacher learning.

Research design and analytical models. We are persuaded that the field does not need any more limited case studies of teacher learning. This does not mean that we believe that field studies would not be important research methods for future research, but we do believe that future research on teacher learning from professional development will require some larger scale studies that allow for both planned variation and control. However, the research that is needed would have to go well beyond the limited large scale and quasi-experimental studies that have been reported and/or that are underway. Our research illuminates variables that need to be (better) measured, including input variables like teachers’ entering knowledge and experience, their engagement in the programs, the social capital at their school sites, the alignment of policies with the reforms’ practices, to mention a few. Outcomes would have to entail something other than teachers’ self reports of satisfaction or learning (given the fact this research: within fidelity there seemed to be at least three issues that need to be teased apart: comprehensiveness of implementation and depth/surface as we mention here, as well as the perplexing developmental issues that we described earlier in this report.

44 Our caution does, however, have implications for the dissemination of certain tools. For instance, since the Tools for Teachers focuses on patterns in student work on mathematics problems, one presumes it will be helpful to a broad spectrum of teachers and scholars. Teachers who use the MARS assessments and scholars who study students’ mathematical thinking would find those analyses interesting. However, the WWIS and the Mathematics Teaching Rubric (as well as a rubric that was developed for districts to assess their process) might be not have as wide a dissemination since those rubrics so clearly articulate pedagogical and curricular ideologies.
that we found significant differences between what teachers reported as helpful and the participation patterns that were most closely associated with their change).

We also would argue for greater investment in analytic techniques that can capture the complexities of professional development. Although hierarchical linear modeling is particular appealing to many researchers right now, we find such a model problematic for research on professional development programs that are long term and that “go to school.” For example, schools are not “nested” within such programs, nor are programs nested within schools. Teachers’ instruction is both an outcome measure and an opportunity to learn (an input). To put it simply, we need analytical models that align with the theories of change and learning that animate the professional development programs in question.

Separating the research from the practice of professional development.

Future research on professional development also would require full participation of teachers; we cannot rely on the reports of volunteers (who are likely to have volunteered either because they are “professional development junkies” or they have a bone to pick). Quality research would also entail considerable time on the part of the participants, for the kinds of measurements we need of teacher knowledge, skill, engagement, and instrument, no matter how streamlined they become, will require significant time. Thus, it is appealing to think of partnerships between professional developers and researchers. Given the fact that professional development would improve if programs had access to reliable data on what teachers were actually learning, these partnerships might seem particularly attractive. However, our experience on this project and others (Galosy, Rozelle, Mikeska, & Wilson, in progress) makes us wary. Researchers are caricatured as the “bad guys” (stealing time away from the professional development and asking “accountability” like questions – Did you learn anything?). As we have mentioned earlier in the report, while we aimed for productive relationships with all of the SVMI and ECRW staff, teachers sometimes were skeptical of our affiliations (with equal numbers worried that we were or we were not associated with the Noyce Foundation).

And at least one staff member resisted any and all attempts at serious intellectual engagement with us and, while professionally polite, was (sometimes) hostile to the research. Less problematic, yet still challenging, was the fact that when we reported to staff and trustees about what we were learning, any critical commentary had implications for future access. We support the idea of researchers being obligated to work together with professional development staff throughout the course of research, but we are less sanguine about the costs such conversations have in terms of the quality of the research and access. Furthermore, the distance that being an observer often provides a very different perspective on an event, or a series of events. It did not always seem appropriate to say what we thought, for doing so threatened access. One needs trust to conduct research, discussions about alternative viewpoints on the professional development programs can threaten the development of trust. An example: there were times when it seemed that the staff presumed that teachers who were not avidly engaging were “resistors.” Calling someone a “resistor” is different than calling them a “skeptic,” or “critical consumer,” both of which might have also been accurate descriptions of teachers who did not wholeheartedly embrace the ideas and materials presented in SVMI and ECRW. Teachers who were less willing to immediately embrace the ideas sometimes had good reason to be given the lack of substantial research evidence to support many of the ideas presented in either program. But had we asked the professional development staff about their tendencies to presumption resistance rather than skepticism, we would have been threatening our access to their ideas and future meetings. In the end, while the promise of open access was alluring, we discovered we were also naïve about the consequences of doing research funded by the very Foundation that supported the programs we were learning in, from, and about.
We close with one final observation. Thus far in the conclusion, we have focused on the complexities of documenting and explaining the effects of professional development programs on teachers' learning. But it might also be important to ask: Given all of this variability and complexity, ought we even try to track the effects of professional development on teachers (as individuals)? We agree that the quality of professional development programs, in the end, ought to be judged by its effects on students (P. Noyce, 2006). Otherwise, the evidence offered is circular: Researchers can show that teachers report that they taught in the ways and with the materials envisioned by the professional development program. Without evidence that students learned more, all we really know is that teachers were persuaded to buy into an ideology. And as we have already mentioned, the Foundation required that both programs actively collected such data. SVMI staff have repeatedly demonstrated improvement in most student achievement on the MARS assessments; reports on ECRW also suggest growth in student writing in portfolio assessments.

Throughout our research, however, we were reminded that improved tests scores can be due to any number of factors. Just the attention alone of the Foundation might have influenced student achievement; acclimating to the assessments might have led to continued improvement; selection biases associated with the school districts might contribute. These threats to the internal and external validity of claims that are made about the relationship between either of these programs and student achievement led us to be much more cautious about presuming a direct link between the professional development, teacher learning, and student learning. Furthermore, given the systemic view of reform that underlies each program, it may be that the effects are system or community effects, not individual teacher effects. For instance, if we had measured change of school cultures or schools as learning organizations, we might have found a clearer connection between professional development and teacher learning. It may just be that the individual teacher learning is simply not the most appropriate unit of analysis.

We, of course, are not the first researchers to struggle with this issue. McLaughlin (1987) in her description of lessons learned from the first two “waves” of policy implementation research recounted similar frustrations in identifying predictable patterns in how and why policies were (or were not) implemented with fidelity:

*Implementors, we discovered, did not always do as told (as proponents of scientific management would have it) nor did they always act to maximize policy objectives (as many economists would have it). Instead those responsible for implementation at various levels of the policy system responded in what often seemed quite idiosyncratic, frustratingly unpredictable, if not downright resistant ways. The result was not only program outcomes that fell short of expectations but also enormous variability in what constituted a “program.”* (p. 172)

Teachers are the authors of their own professional development paths, and it might be that efforts like this one, focused on understanding patterns in when, what, and how teachers learn should use a larger unit – perhaps groups of teachers, or entire schools – for their analysis. It may be that at the individual teacher level, we will always be confronted with the unpredictable, idiosyncratic quality of an individual teacher’s pathway through professional development.
Steady Work: Implications for The Practice of Professional Development

This does not, however, mean that we did not learn a great deal from this research. Organizational theorists sometimes write of “sensemaking”:

[T]he experience of being thrown into an ongoing, unknowable, unpredictable streaming of experience in search of answers to the question, “what’s the story?” Plausible stories animate and gain their validity from subsequent activity. The language of sensemaking captures the realities of agency, flux, equivocality, transience, reaccomplishment, unfolding, and emergence, realities that are often obscured by the language of variables, nouns, quantities, and structures. . . . order in organizational life comes just as much from the subtle, the small, the relational, the oral, the particular, as it does from the conspicuous, the large, the substantive, the written, the general, and the sustained. To work with the idea of sensemaking is to appreciate that smallness does not equate with insignificance. Small structures and short moments can have large consequences. (Weick, Sutcliffe, & Obstfeld, 2005, p. 410)

And so it is with research on and the practice of professional development. Perhaps the most important lessons to be learned from these two programs have to do with the nature of what Elmore and McLaughlin (1988) called “steady work” – the unglamorous, pedestrian “plugging away” involved in conceptualizing and offering effective professional development. And so we conclude this report by offering some observations that might inform future practice of professional development.

For one, it seems important to remember that teachers do not always know what they need to learn, and that a wide portfolio of opportunities needs to also come with a guide for being a wise consumer of such opportunities to learn. Second, we were struck with the fact that disciplinary engagement does not always lead to increased content knowledge, for such learning opportunities are ripe with other lessons-to-be-learned. If the purpose of such occasions is (sometimes) to develop content knowledge, then professional development leaders might want to focus teachers’ attention on the substantive content of such occasions, and develop activities that help assess that learning.

That teachers’ self reports of the activities that were helpful did not align completely with the patterns of engagement that led to increased knowledge and confidence also seemed important to us. Asking for participants’ evaluations at the end of workshops might make participants feel “heard,” but using those to assess the utility or effectiveness of such an occasion might be problematic. Professional development staff, like teachers, need on-going formative assessments of what they are trying to teach (content knowledge, for example) that are, to paraphrase the National Board for Professional Teaching Standards, professionally responsible and publicly credible. We have passed the moment where it is appropriate for professional development staff to simply use evaluation cards left at the back of the room at day’s end. Nor can it be seen as the sole responsibility of the “researchers” to collect evidence of teacher learning. The “measures of instruction” that evolved in the form of the WWIS and the Mathematics Teaching Rubric might have some potential for informing the development of such assessments. This would also help the program staff make more transparent to all participants (not just the coaches) what the underlying normative view of teaching and learning is.

However, this leads to yet another observation: Each program, characterized as it was by a pedagogical ideology, both drew power from that stance and was limited by it. “The Noyce way” was inspiring to many participants, energizing and animating the teachers who were committed to taking those ideas into their classrooms. But “the Noyce way” can also be seen as blinding: There is not empirical evidence, for example,
that a teacher who uses direct instruction is “limited” in the ways constructed by the Mathematics Teaching Rubric. Similarly, there is not definitive empirical evidence that any form of “writer’s workshop” is a more effective instructional model than other approaches to the teaching of writing (e.g., Harris, Graham, & Mason, 2006). Ironically enough, while both programs argue that teachers need to be open to and listen/learn from their students, the urge to push a particular pedagogical agenda sometimes silenced the teacher-learners in the programs who were not of like mind. The challenge here is not to avoid such commitments (no one can escape having an ideological perspective), but to “hold” them in such a way as to remain open to challenge and change, and to use those challenges (by both teachers and outsiders) to continually improve the programs.

To paraphrase T. S. Eliot in The Four Quartets, in our end is our beginning. This was a study of teacher learning, but it was also a study of professional development program learning. From this perspective, we learned that, if they are to thrive, professional development programs – like the teachers they nurture – require deep, long term commitments and diverse resources. Like teacher learning communities, they need both inside and outside expertise (Huberman, 1993, 1995), and a variety of tools and measures to assess their effects. There is some evidence that the new paradigms for professional development can be powerful learning experiences, but assumptions that good professional development programs can be pedagogical “silver bullets” miss the complexity of teacher and student learning. Progress in both offering and researching professional development requires building strong visions of what is possible for teachers and their students – evident in both SVMI and ECRW – tempered with sharp scrutiny that considers that complexity an its implications for how to better offer professional development and how to conduct high quality research on its content, character, and outcomes.

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45 Another teacher, a principal, coach, or professional development leader could do this silencing. Openness to critical perspectives on the normative views of the programs varied considerably across the actors.

46 We thank Jodie Galosy for these insights.
References


### Appendix A

**ECRW Scales**

<table>
<thead>
<tr>
<th>Item*</th>
<th>Corrected Item-Total Score Correlation</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gave me many opportunities to work on aspects of my teaching</td>
<td>0.65</td>
<td>0.81</td>
</tr>
<tr>
<td>Provided me with useful knowledge or information</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Led me to think about an aspect of my teaching in a new way</td>
<td>0.53</td>
<td></td>
</tr>
<tr>
<td>Led me to try new things</td>
<td>0.68</td>
<td></td>
</tr>
</tbody>
</table>

Table A.1. 2003 ECRW Teacher Learning in Practice Scale

<table>
<thead>
<tr>
<th>Item*</th>
<th>Corrected Item-Total Score Correlation</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gave me many opportunities to work on aspects of my teaching</td>
<td>0.54</td>
<td>0.76</td>
</tr>
<tr>
<td>Provided me with useful knowledge or information</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>Led me to think about an aspect of my teaching in a new way</td>
<td>0.52</td>
<td></td>
</tr>
<tr>
<td>Led me to try new things</td>
<td>0.61</td>
<td></td>
</tr>
</tbody>
</table>

Table A.2. 2004 ECRW Teacher Experimentation Scale

<table>
<thead>
<tr>
<th>Item*</th>
<th>Corrected Item-Total Score Correlation</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy writing more.</td>
<td>0.64</td>
<td>0.84</td>
</tr>
<tr>
<td>I am a more confident writer.</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>I write more often</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>I enjoy teaching writing more.</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>I am more confident about teaching writing.</td>
<td>0.52</td>
<td></td>
</tr>
<tr>
<td>I want to learn more about the teaching of writing.</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>I read more children's literature</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>I read more professional literature</td>
<td>0.57</td>
<td></td>
</tr>
</tbody>
</table>

Table A.3. 2003 ECRW Teacher Confidence Scale

*Teacher Learning from Professional Development*  
132
<table>
<thead>
<tr>
<th>Item*</th>
<th>Corrected Item-Total Correlation</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy writing more.</td>
<td>0.64</td>
<td>0.82</td>
</tr>
<tr>
<td>I am a more confident writer.</td>
<td>0.56</td>
<td></td>
</tr>
<tr>
<td>I write more often</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>I enjoy teaching writing more.</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>I am more confident about teaching writing.</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>I want to learn more about the teaching of writing.</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>I read more children's literature</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>I read more professional literature</td>
<td>0.55</td>
<td></td>
</tr>
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</table>

Table A. 4. 2004 ECRW Teacher Confidence Scale

<table>
<thead>
<tr>
<th>Understanding how different students learn to write</th>
<th>Corrected Item-Total Correlation</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching students how to revise</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>Teaching students procedures for getting feedback from peers</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>Teaching students conventions of writing</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>Knowing how to find/create resources for use in teaching writing</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>Encouraging student to share their writing in class</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>Helping students become self-motivated and self directed</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td>Building student familiarity with mentor books and authors</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>Using a variety of assessment methods</td>
<td>0.71</td>
<td></td>
</tr>
</tbody>
</table>

Table A. 5. 2003 ECRW Teacher Pedagogical Content Knowledge in Writing
<table>
<thead>
<tr>
<th>Understanding</th>
<th>Corrected Item-Total Correlation</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding - How different students learn</td>
<td>0.46</td>
<td>0.86</td>
</tr>
<tr>
<td>Understanding - How to learn revision strategies</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Understanding - How to teach peer conferencing</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>Understanding - How to teach conventions of writing</td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>Understanding - How to find/create resources</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>Understanding - How to help students become self-motivated</td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td>Understanding - How to build student familiarity</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>Understanding - How to use a variety of assessment methods</td>
<td>0.66</td>
<td></td>
</tr>
</tbody>
</table>

Table A. 5. 2004 ECRW Teacher Pedagogical Content Knowledge in Writing
# Appendix B

## SVMI Scales

<table>
<thead>
<tr>
<th>Item</th>
<th>Corrected Item-Total Correlation</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy mathematics more.</td>
<td>0.54</td>
<td>0.83</td>
</tr>
<tr>
<td>I am a more confident mathematical thinker.</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>I enjoy teaching mathematics more.</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>I am more confident about teaching mathematics.</td>
<td>0.56</td>
<td></td>
</tr>
<tr>
<td>I want to learn more about mathematics and the teaching of mathematics</td>
<td>0.71</td>
<td></td>
</tr>
</tbody>
</table>

*aAll items coded: 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree, 5 = no opinion*

Table B. 1. 2003 SVMI Teacher Engagement/Satisfaction Scale

<table>
<thead>
<tr>
<th>Item</th>
<th>Corrected Item-Total Correlation</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy mathematics more.</td>
<td>0.59</td>
<td>0.80</td>
</tr>
<tr>
<td>I am a more confident mathematical thinker.</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>I enjoy teaching mathematics more.</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>I am more confident about teaching mathematics.</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>I want to learn more about mathematics and the teaching of mathematics</td>
<td>0.45</td>
<td></td>
</tr>
</tbody>
</table>

*aAll items coded: 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree, 5 = no opinion*

Table B. 2. 2004 SVMI Teacher Engagement/Satisfaction Scale
<table>
<thead>
<tr>
<th>Item</th>
<th>Item/Total Score Correlation</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding the concepts, knowledge, and skills necessary to</td>
<td>0.77</td>
<td>0.97</td>
</tr>
<tr>
<td>Knowing how to find/create resources for use in teaching</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Maintaining an orderly, purposeful learning environment for</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>Understanding how different students learn mathematics</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Teaching to the whole class</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>Teaching small groups of students</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>Teaching individuals</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>Having students use notebooks to record their understanding</td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td>Encouraging students to share their mathematical ideas with the</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Encouraging students to share their strategies and approaches to</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>Choosing different teaching strategies for different instructional</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Teaching students mathematical conventions</td>
<td>0.82</td>
<td></td>
</tr>
<tr>
<td>Using a variety of assessment methods</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>Setting appropriately challenging expectations for students</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Helping students become self-motivated and self-directed</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>Developing mathematics lessons and units</td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td>Teaching in ways that support new English language learners</td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td>Using teaching strategies that promote student inquiry</td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td>Encouraging students to revise their thinking as they justify</td>
<td>0.82</td>
<td></td>
</tr>
</tbody>
</table>

Table B. 3.  2003 SVMI Teacher Pedagogical Content Knowledge in Mathematics Scale
<table>
<thead>
<tr>
<th>Item</th>
<th>Item/Total Score</th>
<th>Scale Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding the concepts/knowledge/skills</td>
<td>0.53</td>
<td>0.91</td>
</tr>
<tr>
<td>Knowing how to find/create resources</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>Maintaining orderly/purposeful learning environment</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>Understanding how different students learn</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>Encouraging students to share strategies/approaches</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>Choosing teaching strategies for different instructional</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>Teaching students mathematical conventions</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>Using a variety of assessment methods</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Setting appropriately expectations</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Developing mathematics lessons/units</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Teaching that supports new English language learners</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>Teaching strategies that promote student inquiry</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>Encouraging students to revise their thinking</td>
<td>0.64</td>
<td></td>
</tr>
</tbody>
</table>

Table B. 4. 2004 SVMI Teacher Pedagogical Content Knowledge in Mathematics Scale