

From Crystal Building to Crystal Gazing: The Growth of a Professional Development Project

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This work examines the experiences of participants in an on-going professional development effort, Project SMART (Science and Mathematics Applied Resources for Teaching). For the past 13 years, Project SMART has included a two-week summer institute in which teachers learn about teaching elementary science and mathematics as they develop interdisciplinary units that integrate a field excursion to a local business or industry. The institute also highlights a current issue in education. During the year we write about, the focus was on action research. During each school year, institute participants implement the curricular units, conduct workshops to introduce others to Project SMART's curriculum model, and conduct research based in their teaching experiences. A core of the participants is returning teachers, so the institute has also developed its own culture. The co-authors represent teacher education faculty and K-8 teachers. In spite of our common experiences we have very different views of what this project means for our teaching and our careers as educators. Our goals in this work are 1) to portray how different, and competing perspectives on this professional development project can co-exist; 2) to use this understanding to inform other professional development institutes and to capitalize on the differences that help us grow and contribute to the field of teacher knowledge of practice; and 3) to provide a forum where the knowledge of teachers can co-exist with the knowledge of professors of education.

Introduction

We will be describing the experiences of participants in an on-going professional development effort, Project SMART (Science and Mathematics Applied Resources for Teaching). For the past 13 years, Project SMART has included a two-week summer institute in which teachers learn about teaching elementary science and mathematics as they develop interdisciplinary units that integrate a field excursion to a local business or industry. Based on teacher input, the institute also highlights a current issue in education, such as multi-cultural education, educational

technology, and during the year we write about, action research.

During each school year, participants implement the curricular units, conduct workshops to introduce others to Project SMART's curriculum model, and (starting the year we write about) conduct research based in their teaching experiences. Most of the participants are returning teachers, so the institute has also developed its own culture. The co-authors represent teacher education faculty who have worked with this project for 13 years, a teacher education faculty member who has worked with the project for four years, a former elementary teacher who coordinates

dissemination efforts for the project as well as supervising elementary student teachers, and two elementary teachers with more than 40 years combined teaching experience. In spite of our common experiences we have very different views of what this project means for our teaching and our careers as educators.

Our goals are (1) to portray how different, and competing perspectives on this professional development project can co-exist; (2) to use this understanding to inform other professional development institutes and to capitalize on the differences that help us grow and contribute to the field of teacher knowledge of practice; and (3) to provide a forum where the knowledge of teachers can co-exist with the knowledge of professors of education.

Our efforts follow the path of Cochran-Smith and Lytle (1993) in which they describe long-term professional development projects that have evolved into teacher research sites where teacher knowledge of teacher practice is generated and shared. Our goal is to contribute to "a different theory of knowledge [that] would not simply add new knowers to the same knowledge base but would redefine the notion of knowledge for teaching and alter the locus of the knowledge base and the practitioner's stance in relation to knowledge generation in the field" (p. 62). Our recent foray into teacher research came from experienced teacher participants who have gradually taken leadership roles in planning and conducting each institute and follow-up activities. Each author has developed a paper reflecting her perspectives, experiences and interests in the project. Each paper makes use of extensive data sources and addresses the position of the author within the context of Project SMART.

ELAINE'S STORY AS THE LONG TIME PARTICIPANT

The Crystal in the Rear-view Mirror: Teachers Looking Back on their Project SMART Experiences

Elaine Suskin

The Need To Know

As a student who was educated in the late 1950's and 1960's, I remember that all of my "learning" came from textbooks. Very little of what I was taught in math or science during my elementary or junior high years involved any use of manipulatives or hands-on experiences. It wasn't until high school that any type of lab work occurred in science, and math was strictly from books. Needless to say, I avoided both of these subjects and took the courses that were required, and did not do well. Even as a college student, preparing for a career in education, I took only those math and science courses which were absolutely required.

It was when I entered the teaching profession that I realized how poor my background was in these areas and that I needed to learn more about these "dreaded" subjects

so that I could be an effective teacher. I began to take graduate level courses in math and science that gave me hands-on activities that I could use in my elementary classroom. Eventually my dread of these subjects began to disappear. I looked for more activities to use with my students, and literally began to learn by myself what I lacked in my background.

My school district was looking for teachers to work during the summer with a group of teachers from the county to create a series of hands-on activities to be used in the school districts' elementary science programs. This need for hands-on experiences (National Science Resources Center, 1988) was caused by the mandate in New York for changes in the way science would be taught. In 1987, the Oswego County Teacher Center conducted a survey of its elementary teachers and found that most of the teachers were unsure of their ability to teach the students in preparation for the new state test. Workshops were held in the county to help teachers use hands-on activities in their classrooms, but more was needed. Because I had been involved in the original group of teachers to develop the activities, I was one of the teachers asked to conduct science hands-on workshops. I was asked if I would be interested in working to create more science workshops. Only this time the group would meet at SUNY Oswego, and we would be working with college professors. I accepted the invitation. Thus, my association with Project SMART began.

The Journey Begins

The first summer in the Project was an exciting but unsettling experience for me. I was nervous about working with high school and college professors who really taught science. I didn't have a background in physics. My experiences with past college professors was from the early 1960's, and rather negative at that. Now I was faced with working with these learned people every day, trying not to look stupid.

My association with these professors was the most positive experience that I had ever had. I remember clearly the day we went to the physics lab to work on some activities to "see if they would work." It didn't occur to me until long after that they knew the activities would work. However, I was encouraged to be the student, to make suggestions and mistakes, and to discover for myself the principles that I would eventually be teaching to other teachers and to my students. I was treated with respect and allowed to take that crucial step from one who somewhat feared science to one who now looked forward to the learning.

I had many other positive experiences in my subsequent years with the project. I helped conduct workshops for my peers, I began to present at local conferences, and eventually presented at state and national conferences. Would I have done this before joining Project SMART? There is no way I would have had the inclination or support to do so.

Have I undergone any changes in my years with the

Project? My feelings of confidence became stronger (Lange & Burroughs-Lange, 1994). I also felt less isolated in my role as a classroom teacher. I had become part of a network of teachers who worked together and shared ideas and teaching strategies. I no longer had to rely solely on myself to solve all of my academic problems (Boles & Troen, 1994). This network led to many opportunities to work collaboratively with teachers from the elementary to college level (Darling-Hammond, Bullmaster & Cobb, 1995). I moved from the role of teacher-follower to that of teacher-leader. This move to teacher leader provided me with a stronger sense of voice (Young, 1993), qualifying me to work on the development of strategic planning for my school district.

As I reflected on these changes, I wondered if this metamorphosis was unique to me or if others had had similar experiences. This led to my search in the literature to see if other long range projects, such as Project SMART, had similar results.

Searching for Answers

At this point I decided to look at the project and other participants' perspectives to see if they experienced similar changes. Within the Project is a core of 14 teachers who have returned each summer for five or more years. These teachers were products of the educational philosophies of the late 1950's and 1960s. All are married, European-American females ranging in age from the mid-thirties to mid-fifties, teaching elementary grades in either rural or small town communities. My reflections lead to the formulation of the questions for my research. I wanted to know what compelled these teachers to return to the project each summer. Did they "get" something out of returning each year?

I chose a qualitative design for my study because it would give a more realistic picture of the other Project SMART teachers' perspectives. My self-reflection on my experiences produced four areas of change for me: confidence, release from classroom isolation, leadership opportunities, and the development of professional voice. It was with these expectations that I began my research.

During the summer of 1996, experienced Project SMART teachers and teachers new to the project interviewed each other, the interviews being taped. I listened to these tapes and transcribed them, and identified recurring patterns. Subsequently, I set up a second set of interviews with the teachers, this time on an informal basis with one person at a time. I met with these teachers in a variety of scenarios: at their homes, in their schools, at the Project SMART lab and at my home. I asked participants to respond to questions such as "How did you become involved in SMART? Why have you continued? What have you learned? How have you changed?" Each interview was tape-recorded, lasting between forty-five minutes to one hour. As I was tape-recording, I was also taking notes, writing down key words and using them to formulate further

questions. The interviews were informal, often with both of us talking, sharing ideas, and refreshing each other's memories about events that had occurred over the time span of the project.

As I analyzed the interview data, I became aware of repeating patterns of information. Patterns observed included teachers commenting on: the people in the project and working with the "best of the best," the ability to develop professional networks, being on the cutting edge of educational issues, the impact on the children, working with college professors as equals, and the chance to complete the Masters program. All of the participants in the study continually prefaced their remarks with "If it hadn't been for the Project" or "Without the support of the project." One participant observed in her interview that being in Project SMART was "being in deep with right-brained thinkers. It was challenging, thrilling, (these people) were shooting off sparks!"

I noticed relationships in these emergent patterns and formulated two new themes: the project as a means to professional interaction, and the project's support for educational advancement: in the classroom and professionally. One teacher in the study shared that "in the project there is always someone who will help you find answers," while another stated, "It's like a family, we are interested in each other as people, people caring about each other. The teachers are such a plus, the support is there." Professionally the teachers in the institute who decided to complete their Masters stated, "I would never have thought about getting my Masters if it hadn't been for the support of the project."

The Crystal in the Future

The findings in this study will act as a guide for Project SMART in the future. If long-term participation in a professional development project promotes positive and continuous change for the teachers in it, then we need to more of this.

ANN'S STORY AS THE PARTICIPANT TURNED STAFF MEMBER

The Mirrored Face of the Crystal: Teachers Reflecting on Their Efforts Through Action Research

Ann Keen

An Invitation To Join

Coming from a self-contained classroom and being the only fourth grade teacher in my school, I attended any teacher workshop I could that was pertinent for my grade level. I attended one such workshop in the fall of 1989 presented by some Project SMART teachers geared toward hands-on science instruction. These teachers had something I wanted! They had ideas, activities, and units of study

geared toward my students. I was intrigued and wondered how I could get involved. I remember clearly thinking I would attend a summer institute and listen carefully to "those in the know." They would teach me how to conduct this hands-on instruction that I would go back to my school and do whatever I was told. Not so. I was instead encouraged to move in my thinking from listening passively to actively creating a unit with other teachers. My enthusiasm for such involvement was mirrored in the faces of my peers. Our knowledge and experiences were acknowledged and honored. We co-partnered with university faculty and teacher peers to create challenging curricular connections for students.

My Growth and Experiences

Here I was, the eager teacher participant learning about good teaching practices, student outcomes and alternatives, curricular connections and a whole lot more. I was thrilled and then came the nudge. I was encouraged to lead a teacher workshop for the county teacher center. It went great. Then I was nudged to present our project-teaching model to the pre-service teachers at the college. Challenging, but it went great. When a Project SMART teacher and I were sitting on a plane heading for Florida to disseminate our project, we both thought, "What were we thinking? Can we do this? Are we ready?" It was exciting and went great. Soon, I had thoughts about leaving my classroom and doing dissemination for the project at local conferences and at district requests. I did that, too, and it's been great. I joined a group in London, England at a math conference to share our project, and believe it or not, it went great. But then—another nudge—would I consider doing a Master's thesis since I had so many courses already completed? I remember thinking, "Stop nudging, will you?"

Coming to Research

A group of elementary classroom teachers, who have participated in this project from 1988, had been reading about action research. These teachers and I expressed an interest in learning the process of action research (Sagor, 1992). We wanted to study the impact of this project on us as teachers and on our students. The data collection since 1987 would allow us to look into the mirror and see how it reflected our work. As classroom teachers working alongside university professors we felt we had a story to share with other teachers. We had a model for professional development we believed successful.

Action research encourages classroom teachers to look systematically at their educational practices and conduct their own research to improve what they are doing (Stenhouse, 1985). Teacher researchers set up a plan to act upon their findings, and continue to evaluate the outcomes (Cochran-Smith & Lytle, 1993) and later share their findings

with interested parties (Sagor, 1992). The 1996 summer institute focused on teaching teachers to do action research. There were forty-five participants in this institute. I saw the challenge and wanted to study the process, the reactions, the faces, the way of talking about action research.

Research Questions

What were the experiences of forty-five elementary classroom teachers participating in a summer institute focused on action research? What was the developmental process? What were the barriers or obstacles they faced and how did they overcome these barriers?

Data Collection and Analysis

I wanted to take the time to record what we were doing as we followed this action research process. I had read that research by teachers represents a distinct way of knowing about teaching that will alter—not just add to—what we know in the field (Cochran-Smith & Lytle, 1993). I chose a qualitative design, which combined observations, journal notes of the teacher participants, discussion participation, my field notes, and audio and videotapes. During the summer institute I took daily field notes focusing on teachers' responses to action research. I audiotaped semi-structured, paired interviews in which teachers articulated their understanding of action research and its role in teaching. I collected copies of teacher's written action research plans. I analyzed this data from multiple sources using the constant comparative approach (Bogdan & Biklen, 1992). I coded and categorized teachers' reactions and found three emerging themes: levels of comfort, attitudes about action research, and obstacles teachers expressed about becoming researchers.

Findings

The teachers' level of comfort ranged from very receptive, open, eager, and willing, to polite interest, to feeling over-whelmed, to uneasiness, to refusal to participate. There were several teachers who from the first day of the institute, considered themselves researchers and even expressed that their students saw themselves as researchers.

Teachers who had been involved with Project SMART for several years and who had experiences in teaming mirrored an eagerness. Teachers who were able to connect action research to what was happening in their classrooms mirrored interest and active listening. Teachers new to teaching and new to a grade level mirrored a look of being over-whelmed and not ready to show interest at this point in their lives.

Teachers' attitudes about action research surfaced positively during the interviewing activity. They were comfortable talking one-on-one with another teacher, expressing the feelings they had, and questioning or confirming thoughts of peers. Teachers quickly identified

obstacles to engaging in action research. Their concerns were threefold: time, money, and support. "How are we supposed to integrate research into our already packed teaching day?" they asked. Some however, felt willing to try to fit it in with what they were already doing. Several expressed ideas for involving their students in the process of classroom research. Having the support from administration, as well as from the general public, came out as a concern. To overcome this concern, a teacher suggested inviting newspaper writers to a teacher conference and then inviting them into the classroom to see the follow through with students.

Future: Through the Mirrored Face of the Crystal

This project will provide a place for teachers to learn, grow, improve, and evolve. Teachers will see changes for themselves when they look into the mirror. They will continue to be nudged, challenged, to be contributors of new ways of thinking about what it means to be a teacher for today's kids.

NANCY'S STORY AS THE TEACHER RESEARCHER

The Crystal Close-Up: Using Action Research to Assess the Impact of a Parent Involvement Initiative.

Nancy Labbe

Buried Crystals—Discovering the Project

I discovered the Project SMART summer institute in 1991 as an experienced teacher having taught for almost two decades. Hands-on, active, collaborative learning had always been my strength. However this type of environment was foreign during my undergraduate years and the early years of my teaching. When I was introduced to the project, the project philosophy, and the community of pride that engulfs the participants, I knew I had found a safe haven that would allow me to grow, accept my differences, and nurture my strengths as a professional. The crystal formations that had been seeded deep in my mind were discovered and claimed by the project unity. My notions about the creation of successful learning environments and relevance to the real world began to unfold, and became grounded in research (DeVries & Zan, 1994; Fosnot, 1996).

Mining the Crystal—Personal Growth

During the early 70's, New York required all educators to earn a masters degree or obtain 30 graduate hours within a five-year period. Fighting the establishment as all red-blooded youth of that era, I chose the thirty hours. "Why should I take a set course of study, when I can design a 30 hour program that suites me as a learner?" No one took the time or listened to my needs as a learner until I was embraced by the energetic project staff and seasoned veteran teachers.

By the time I had finished my second year as a Project SMART teacher, I was enrolled in a Masters Degree program, was planning and presenting workshops on a regular basis, and had drafted a plan for a sabbatical leave.

Authentic assessment and self-esteem became the primary focus of my one-year leave. I assumed the role of graduate assistant/adjunct professor and worked out of the Project SMART research lab. I was consumed by my own research, the effects of the research on my own district, and also the project, and the daily controlled chaos of the lab. The planning team decided to use authentic assessment as a theme for the summer institute. Since my sabbatical leave my role in the district has changed. I am a classroom teacher first, but I often find myself in the role of staff developer for the district, the project and the county. I have been involved in statewide initiatives and have presented at national conferences. The outcomes of my leave are similar to the faceting and polishing of a crystal. The opportunities for further professional growth continue to unfold and be nurtured as I take the time to reflect, formulate new questions, and seek answers.

Learning to Facet—Becoming a Researcher

My picture of research had always been number crunching. My students had kept journals and learning logs in my classroom for years, but I had never consciously thought about looking for patterns in their thinking or feelings and documenting the results. Quantitative and qualitative findings were now tools to intentionally understand what was happening in my classroom, and each had its own place in my professional toolbox. How could we (my teammates and myself) conscientiously inform the students, parents and community about the educational practices in our classroom without collecting data to document our work?

I had a new challenge. I began to read more and at a Project staff meeting suggested we introduce action research as a theme for the summer institute. The project directors had background in qualitative design and a need to continue documenting the outcomes of the project. Why not teach us as they collect and analyze the data? The project staff decided to go with the idea and a planning committee was formed.

Gathering the Tools—Formulating the Questions

As a member of an inclusion teaching team, I am continually questioning social involvement and academic growth. My teaching team wanted more parental involvement in our classroom. We felt this would boost student achievement. In the small, predominately white, rural community where I teach, parental involvement had always been minimal. Our building has 46% of its students on free or reduced lunch programs and the district is 88% state funded. Even with continual written correspondence and the initiation of the Homework Hotline technology during the 1995-1996 school year, we had less than 40% of our

students turning in homework on a consistent basis and little parental participation. With the push in the state for higher standards, we questioned how we were going to meaningfully convey the new criteria to the parents.

During these discussions, our local teacher's center sent out the criteria for mini-grant proposals. The goal was to fund programs that were working toward collaboratively integrating the new state frameworks into classroom activities. With the premise that productive learning cannot be done in isolation (Wagner, 1996; Theobald, 1995) we proceeded to write a grant proposal. By initiating four Family Night Partnership Programs, could we increase the parental involvement in our classroom and in turn increase the amount of students who turned in homework?

Cutting the Crystal—Data Collection

Our proposal was accepted and we began to plan for implementation of the Family Night. We would create learning centers to strengthen the skills necessary to achieve specific indicators proposed in the E/LA and MST Frameworks and also to involve parents in the learning process. The team decided to conduct an informal study to track our outcomes. We would prepare parent letters and packets to explain the projects, and modify and design assessment tools to monitor parental interaction and student achievement. We decided to keep journals, track parental correspondence and send periodic survey instruments to parents, monitor the Homework Hotline calls, and monitor the children's SMART Logs (a tool used to track the free reading of students at home). If the parents bought into the Family Night Partnership Programs that would introduce classroom practices to the students and the parent together, would we see sustained family involvement?

Displaying the Gem—Research Results

Over 50% of our student population attended one of the Family Nights with at least one parent. The study helped us reflect on the learning in our classroom and the importance of establishing learning teams of students, parents and teachers so optimal learning can occur. Many parents questioned the validity of the new reform effort, but now have a working knowledge base upon which to build their concerns. About 10% of the population continued to borrow materials throughout the year, and several even questioned school board members.

At the end of the first marking period, our students were asked to complete a reflection sheet to assess their learning over the first ten weeks of school, focus on the areas they were most proud, and to target areas that they wish to improve. They were also asked to list their most and least favorite activities for the first quarter of the year. All but six students listed collaborative lessons as their favorite. This implied that the importance of community had been established in the classroom and that communication skills were being developed. By the end of the first quarter we

had surpassed the number of calls recorded on the Hotline for the previous school year. This suggested that the Family Nights did build a stronger network between home and school.

From my perspective our study seems to replicate the design of Project SMART. Parents understood that active involvement generates learning and also creates an environment where children can discover, question, formulate and integrate their prior knowledge. The family nights were designed to involve parents in the hands-on, inductive learning process that their children encounter each day. With an expanded learning community and support network, more students are being given the opportunity to succeed.

Faceted Gems — Project SMART and the Future

The project continues to be a source of inspiration for me. Its learning community provides a place to learn, grow, and integrate our new knowledge into the setting of our classrooms where its effects ripple throughout the county and the state. The constructivist model exemplifies the standards being advocated by state and national reform. The project provides a safe haven for teachers to become involved in classroom research, reflectively collaborate and implement strategies that inform practice and validate theories. From my point of view the project is a powerful change agent that will continue to be replicated. Ten years ago it was a crystal formation, ten years from now it will be a faceted gem!

BARB'S AND SUE'S VIEWS AS CO-DIRECTORS

The Crystal's Core and Faces: Key Principles of this Professional Development Project and The Project's Growth

Barbara Beyerbach & Suzanne Weber

How We Became Involved in Project SMART

We have been involved with Project SMART since its inception. In 1987 the director of the county teacher center approached staff of the Classroom Interaction Research Laboratory at SUNY Oswego, to seek help in responding to a teacher needs assessment indicating county teachers wanted to know more about hands-on, problem-solving science instruction. At the time Sue was a science educator active in area staff development and grant writing initiatives. She had worked on several NSF funded curriculum development projects. Barb's background was in teaching strategies, and she was working on a NSF funded research investigation in secondary science. Barb identified with teachers' science phobia, having taken the two "gut" science courses of the day in her undergraduate program, and having never taught science in an inductive way. Along with two

other faculty members, we met with teacher center staff and collaboratively crafted a DDE Title II professional/curriculum development project to improve elementary science teaching. This proposal for Project SMART was funded.

Barb's initial role was as program evaluator, and her interests focused on telling the story of the project from the perspectives of the teacher participants. Sue's initial role was as project coordinator, and she planned the collaborative curriculum development process and orchestrated instruction on inductive science teaching. We aimed to develop a collaborative curriculum development project in which teachers felt they had a strong voice. We also acknowledged that we were new at doing "this" and would all "make it up" as we went along. Frequently in the first year teachers would ask, "Is this right?" or "Is this what you want?" and we would deflect the question back, asking "What would make it right? What should it look like? What would be helpful to other teachers?" So criteria for the evolving "model" emerged from these dialogues. However it is fair to say that teachers looked at us as the experts who were supposed to have the answer, and we also often fell into a directive role. We were very nervous that the teachers thought we knew more than we actually knew and were fearful of leading them in a wrong direction. Barb worried about how to share feedback from project participants in a way that would support the project growth. Sue worried about respecting teachers' ideas while at the same time moving them towards more inquiry oriented instruction.

Related Literature

The Kids at Work model is consistent with Lieberman's (1995) and Stallings's (1995) call for a professional development approach that is based on a constructivist, collaborative view of professional learning. Sparks (1995) criticizes traditional staff development approaches as piecemeal reform efforts focusing on a "needed" change without concern for the context. Too often such staff development is based on *telling*—a transmission view of knowledge where content and skills information are delivered first to teachers and then in turn to children. Sparks calls for systems thinking, collaborative and constructivist processes such as action research, and engaging teachers in conversations about assumptions and beliefs underlying practice. Project SMART's Kids at Work partnership engages teachers and seeks to improve student attitudes towards mathematics and science. It is one of few programs to demonstrate positive student outcomes, corroborated by multiple sources of data. It also goes beyond Sparks call by including parents and business community members.

Darling-Hammond and McLaughlin (1995) argue that conventional staff development has been top-down, and what we now need are top-down policies for bottom-up reform. They point out that the new reforms call for teachers to teach in ways that they have not experienced, requiring them to unlearn old practice. They call for participant driven

inquiry/reflection/experimentation in a sustained collaborative community that is connected to other aspects of school change. The "systematic ad hocism" they discuss, whereby structures continually change and evolve to respond to new needs, is reflected in the evolution of the Kids at Work program where new structures emerged to deal with the following teacher-identified concerns: (1) new curriculum opportunities, (2) interdisciplinary teaching, (3) new pedagogical strategies, (4) student assessment strategies, (5) educational technology, (6) teacher research, and (7) program dissemination. These structures created a web of participant-driven professional development opportunities. Lather's (1991) notion of catalytic validity which "represents the degree to which the research process re-orientes focuses and energizes participants toward knowing reality in order to transform it. . ." (p. 18) has recently served as a useful concept in our understanding of our process.

The Crystal's Many Faces: Making Meaning of the Project's Growth

Broadened Focus. Chronologically the focus of the project expanded each year to include (1) mathematics, and then other content areas leading to interdisciplinary units; (2) school administrators as part of the implementation and steering committee; (3) business and industry community representatives, working side by side with teachers to develop real world field excursions exemplifying mathematics and science applications in the work place; (4) parents, and an expanded effort to include children's learning in the home and community; (5) regional, state and national dissemination of the model and curriculum units; (6) project teachers serving as adjunct professors; (7) networking, coordination, and collaboration with other staff development initiatives; and, (8) development of a special graduate program with course work focusing on professional development and action research. This growth of program participants reflects an on-going understanding of the importance of including all members in the community to educate all children. Teachers have expanded their involvement over the course of the project.

Changing Roles. Three 'critical incidents' have been identified by teachers and the research team as having significant impact on our growth within the program as well as our understanding of (and recognition of) the nature of these changes. *First* a pilot study, a survey of children's attitudinal factors — in which all results were significant in the *wrong* direction — provided very discrepant data from that collected through participant observation. The survey data indicated that Kids at Work units tended to make students less satisfied with science instruction, and less aware of the usefulness of science. Yet our observations evidenced children actively engaged in science lessons, generating many real world applications as a result of their visits to industrial sites and the career-focused activities. In searching to understand these discrepancies, we drew

teachers into the data interpretation process. They pointed out that, because of the way teachers described the units to children, their students saw Kids at Work as a separate subject, not as science. Teachers reported that children asked, "Can we do Kids at Work today instead of science?" Re-examination of the classroom data indicated that as children experienced these units, they became more dissatisfied with typical science. This incident helped us revise how the units were presented to children, and strengthened our resolve to include the teachers' voices in data interpretation.

The *second* incident involved shifting roles, as one teacher framed her master's thesis around the participant observation and interview data collected in her classroom and that of a neighboring sixth grade. This marked the point at which a teacher took the lead in framing research questions, and conveyed the power of involving teachers in the research process at all stages. This teacher soon drew others into the research process.

The *third* incident occurred when a cohort of 10 experienced Kids at Work teachers envisioned and initiated a specially designed graduate program in which they could conduct action research and extend their knowledge of professional development. These permanently certified teachers requested, are co-designing, and work as a collaborative cohort in a masters degree program that will build on their interests and common experiences over the past years. Our first teacher just graduated from the program in December 1996, and a dozen teachers are conducting action research investigations. Many of these teachers serve as adjunct instructors in our undergraduate program. These shifts in roles and focus exemplify the type of empowerment from emancipatory research that Lather (1991) describes.

The Program's Core

As we entered our eighth year, we began to explore the questions- "What led to the expansion and evolution of this professional development project? How has it changed and how has it remained the same?" A group of experienced teachers and faculty began a retrospective study examining past grant proposals, papers, field notes on the project and generated the metaphor of a crystal, with faces representing core commitments. This group suggested that the original design of the curriculum development, professional development, and program evaluation model formed a synergy which led to an (1) increasingly broadened focus (2) evolving roles for all participants, and (3) paradigm shifts for all participants. While there were changes, participants also shared some common beliefs and commitments that we believe led to the synergistic development of this project. We use a metaphor of a crystal that represent these common structural elements — one on each of the five faces of the crystal, which led to the growth and expansion of the project in particular ways. The metaphor of a crystal is useful in that certain features have to be present for growth to occur, and the growth is patterned, but unpredictable. The faces of

the crystal represent aspects of the project that have existed from the start of the project, and that cross over to related initiatives (represented by the other crystals present).

Thus we see the project as having built upon five key commitments. The project would be: (1) *Collaborative*—We have been committed to including partners from various walks of life including teachers, university members, business and industry, community members, and parents; (2) *Contextual*—We work with teachers and children in their contexts and across contexts — school, home, and in the world of work; (3) *Sustained*—We believe change takes time, and involves participants and contexts over multiple years; (4) *Employing warranted practice*—We are constantly engaged in reading and conducting research. Topics chosen for study are teacher chosen and are grounded in the research on teaching and learning; (5) *Integrated/inclusive approach*—We seek to integrate topics across disciplines; include all types of learners; include teachers and students from diverse contexts; and to integrate learning experiences across work, home and school contexts. The interplay of these five commitments led to the broadened focus, changing roles, and shifts in understandings throughout the life of this project.

Data Collection

Using documents including nine years of annual grant proposals and annual reports, videotapes and field notes from classroom and institute participant observations, teacher journals and interview data, previously written papers, and correspondence, a writing team of teachers and university faculty delineated themes which ran through institute conversations, documents, and teacher practice. We also examined changes in our practice, language, and activities and clustered these into themes about our growth. The following describes changes in our thinking about the project and about professional development as the program evolved.

Findings

Specifically, we found the following conceptual changes over the years:

1. A change from seeing the goal of professional development as changing teachers, to creating a context where teachers and college/university faculty collaboratively build a knowledge base for improving elementary mathematics and science instruction.
2. A change from viewing elementary science pedagogy as simply an inductively structured teaching process to viewing it as providing a set of experiences within the larger school/community/work force setting.
3. A change from doing research from a more exclusive, quantitative, deductive, multi-variate (particularistic), expert centered approach to an inclusive, interpretive, collaborative complementary qualitative and

quantitative methodology.

4. A change in our view of scholarship from one in which knowledge is generated by university researchers who have power over the process, to one in which scholarship is seen as the articulation of negotiated meanings among all participants on the project, with everyone's voice contributing to the story.

Transformations in the model of professional development were related to changes in our thinking about research, knowledge construction, and collaboration. Participants moved from a view of research as a product to be applied in classrooms, to a view of research as a process in which teachers collaboratively engage to improve teaching and learning.

Future Possibilities

In 1997 a group of two project teachers and two project faculty attended the Annual Ethnography in Education Conference in Philadelphia and were deeply moved by the keynote presentation by Cochran-Smith, Lytle, Maimon, and Waff (1997). We left the session and Barb commented, "We've been playing it too safe on the project". Throughout this three day conference we engaged in conversations about moving to a position of talking more directly *about* teaching, race, class, and gender, rather than talking *around* these topics. We were intrigued by the notion of "free spaces" explored by Lois Weis and Michelle Fine and their students in several sessions. We began to think of the project's potential to be a free space for teachers to take safe risks. We saw the current project as a safe place for teachers to grow, but wanted to push the edges of the boundaries to more deeply explore issues of race, class, gender and pedagogy that we tend to deal with only indirectly. We envisioned setting a new tone for the project, which would encourage deeper exploration of these issues in our curriculum work, with an eye towards teaching as a political activity aimed towards social justice.

PAT'S STORY AS THE NEWCOMER

The Crystal as a Part of the Landscape: Project SMART's Professional Development Program in a Context of Educational Reform

Pat Russo

My Background

I was drawn to this project by what I regarded as a high quality work performance of the two project directors. As a new faculty member in the School of Education, I knew nothing about Project SMART, the summer institute, or the on-going support for teaching elementary mathematics and science. I had come to my position as an assistant professor of foundations of education with experience and long-standing interest in what I then called "staff development," but otherwise, my interest in discussing the sociological and

historical relations between education and society, and my desire to conduct qualitative research seemed far removed from the work of project SMART. Nevertheless, when invited to visit the institute in progress, I took a chance on finding out more about the work of these two experienced and respected colleagues.

My Growth

Upon first visiting the Project SMART summer institute, I was taken with the high level of energy, collaboration, comfort, and interaction among the participants. I was also surprised at the numbers of teachers who began conversations with me by saying something like, "I would never be doing this if it weren't for Project SMART," or "I would never be talking like this, if it weren't for Project SMART." All around me teachers were putting together curriculum units, planning workshops for other teachers, strategizing about the latest state level budget crisis and their need to work with or around local administrators, and talking about readings that related to student assessment. This was much more than a make-and-take session, more than teachers being "developed" by some experts. But how much more? I was at once curious, interested, and skeptical.

I began to work with participants and Project SMART staff, and slowly but surely built on my understanding. During the following year, I attended staff meetings, follow-up meetings with participants, and conferences where I participated in presentations about the project. I joined the planning team of teachers and staff members to develop the next summer institute with a focus on action research and found myself catapulted into the arena of professional development and teacher research. My interest in working with the project and actively considering questions I had about professional development and educational reform continued to grow. This past year I have coordinated a teacher researcher study group whose members include several Project SMART teachers, continued to collaborate with staff and teachers to collect data and present papers at conferences, and participated in planning for future institutes. As I reflect upon this growth, I find that what I thought was merely an opportunity to work with exciting people, and perhaps find a small piece of a research agenda, has turned into a fertile, safe, and nurturing environment for my own professional interests.

My Research Questions

My questions continued to accumulate, reflecting my own background in foundations and my daily experiences with the project. I wondered what was under the surface of this seemingly pleasant facade at the institute. What were the teachers actually bringing to this institute? What were they taking with them? How many really returned each year? Why did they come back? How did the positive energy, effort, and collaboration that I was witnessing relate to the critique of schools I had read from reproduction

theorists to politicians and columnists?

I wondered how this institute compared with other thinking about professional development and school change. What was the relationship between this growing group of teachers and the larger issues of policy and education? What would historians say, if anything, about this effort that seems to play such a big role in many teachers' lives? What was so unique and significant about the professional development model that it had been awarded nearly one million dollars in grant monies over the years, and identified as an exemplary program by the state education department's Sharing School Success evaluation? Why would a superintendent, when speaking at a countywide meeting comment, "Well if anyone can make this (new) effort work, it's a Project SMART teacher?"

I wondered how much the key concepts that the project directors claimed were anchoring the project were truly manifested in the daily interactions of the institute and the follow-up interactions during the school year. How collaborative is the project? For whom is it a sustained experience? What about the teachers who don't return? How integrated and inclusive is it really? Could these teachers really deal with issues of race, class, and gender integration/inclusion? How much do we in the project really attend to the contexts in which teachers work? For this paper, I focused on the relationship of our experiences as a collective with the experiences or thinking of others who are in the business of professional development and reform. How do we fit into the larger landscape of educational reform and professional development?

Data collection

My data is often the data collected collaboratively with or by others. I participated in collecting and analyzing various sets of data to prepare for the most recent institute (Beyerbach, et al, 1995; Beyerbach, et al., 1996; Hawthorne, 1995), develop papers for conferences (Russo, et al., 1997a; Russo & Beyerbach, 1997; Russo et al, 1997b), and support the development of master's theses (Keen, 1996; Suskin, 1997). Thus, I use the evidence in field notes, teachers' learning logs, official project documents, videos of institute sessions, interview transcripts, and my own field notes from a variety of summer institute planning sessions, activities, and follow-up sessions. But I bring a slightly different lens to view this data. I try to understand what meaning the participants make of this project in relation to professional development and educational reform. In other papers, and in this paper, others have established a link between Project SMART and current thinking about professional development (Lieberman, 1995; Stallings, 1995; Sparks, 1995; Darling-Hammond & McLaughlin, 1995; Cochran-Smith & Lytle, 1993). So I wondered if thinking about our links with a history of professional development would provide any insight into the future of our project.

Findings

For more than 150 years, teachers have been attending institutes to learn about new developments (Biklen, 1995; Fuller, 1989; Hoffman, 1985), but more importantly to share information with each other about the application of new developments to their particular contexts. Institutes occurred in pre-civil war times (Biklen, 1995, p. 58); in late 19th and early 20th centuries. Fuller (1989, p. 110), speaking of "rural teachers," stated, "They studied at the county teachers' institutes in the summer, read papers at local teachers' association meetings, and spent a small portion of their salaries for professional purposes." (P. 110). In the early 20th century, Margaret Haley, president of the National Education Association called for teachers to participate in decision making at the policy level and to reflect our country's democratic political process in the profession (Fraser, 1989; Haley, 1981), at a time when teachers were once again seeing that while their field was growing as a profession, they would continue to be relegated to the least important position for making decisions about teaching.

The connection of Project SMART to this legacy of teachers constructing the meaning of their work is especially significant for our location at SUNY Oswego, a college with roots in the normal school development of the mid-nineteenth century. Under the influence of Edward Austin Sheldon, teachers left the normal school here and moved around the country employing what was nationally known in the late 1890s as the Oswego method, or object-method of teaching. Thus we know we have a history. This is not a history necessarily grounded in the theory of education. We are part of a history of *action*, of teachers coming together and collaborating to share, learn from, and grow through their interactions. While policy makers, politicians, and university experts have rallied around the crises of education calling for more than a century and a half of reform after reform (Cuban, 1989), teachers have been quietly and collectively doing the daily, immediate work of teaching.

We are also directly tied to the recent history of the theory-practice split that occurred in the 1950-60s, where the educational research of the time moved "away from the concept of teacher-researcher toward that of teacher-learner" (Noffke, 1997, p. 318). Many of us in the project, came through periods of "inservice" and "staff development" which included inculcation in the models of: DISTAR, Essentials of Effective Instruction, the effective schools movement, and assertive discipline. While some of these programs might be localized only in our region, teachers from other areas of the country could easily develop their own lists of the latest efforts of 'experts' to improve the work of teachers.

It is also not surprising that the funding for the project comes from our link with science pedagogy (and mathematics and technology), and with career awareness. Funding for science and math teaching has increased since

the USSR launched Sputnik in the 1950s. The most recent wave in the reform movement began in the mid-1980s, and again included a call for improvement in students' science and mathematics abilities. Once again the finger of blame was firmly pointed at teachers. With this call for reform came funding directed toward improving science and mathematics instruction, and for the development of curriculum standards. It was in this global, economic policy storm that Project SMART was born. We see direct connections to the science teaching (and mathematics, and now technology) focus, as well as to interest in the standards in the stories of teachers who attend Project SMART summer institutes.

While we can recognize that the work in Project SMART has been influenced by history and by policy issues, we also recognize that our individual and collective growth has occurred in spite of these external developments. We are operating in a parallel universe; a universe of growing crystals where school reform occurs from the bottom up, from the inside out, and from small particular experiences to larger collective experiences. While teachers were attending to professional development, we have found that they were also growing personally. As reported earlier, teachers have become interested in directing the institute's programs and most recently interested in conducting their own research about teaching and their professional experiences. Again, we find this combined professional and personal growth reflected in the literature (Cochran-Smith & Lytle, 1993; Allen et al., 1993; Fine, 1994; Noffke, 1997), particularly in some literature that combines discussion of professional development with action research or teacher research.

However, there is a missing link between the literature of professional development and our experiences thus far with Project SMART. This gap occurs around what Phelan (1996) speaks of as teachers considering the "long term social consequences of a particular mode of instruction." Zeichner and Gore (1995) speak of this when they consider positioning teacher research within a social reconstructionist approach. Noffke (1997) speaks of the relationships between personal, professional, and political aspects of action research, an area we have just begun to explore in Project SMART. She argues that the political (and therefore social) aspects of action research occur simultaneously within professional and personal growth, since all three areas deal with power and control. But she also identifies the political stream of action research and its relationship to professional development as that part of the discussion that focuses on democratic, and social equity, or transformative efforts that emerge in some action research. It is not clear whether teachers in Project SMART will approach this option.

Crystal Gazing—Looking To the Future

It seems clear that Project SMART will continue in a way that teachers will experience both professional and personal growth. Teachers will continue to build and revise

inductively structured, interdisciplinary curriculum units. Teachers in the project will probably continue to act as prime planners of future institutes, and prime presenters at orientation workshops. We might also continue to support each other in conducting action/teacher research. But this aspect of professional development is threatened by the lack of institutional support for writing about their research and sharing it in public forums.

However, it is unclear what other future professional development will occur with the project. Both the professional literature and our recent discussions suggest that we are poised on the edge of critically examining assumptions we hold about our students, teaching, learning, and society. The potential for us to move in this direction with our curriculum development, our program planning, and our research is there

Conclusions

As a group, through our collective experiences in Project SMART, we have revised our thinking about how curriculum is constructed, acknowledging the power of negotiation, collaboration, and reflection as we each contribute to new meanings of teaching, learning, knowledge, and professional development. We have been inspired by the work of Cochran-Smith and Lytle (1993), Allen and others (1993), Fine, and others who speak about the need for and value of working with teachers on professional development. We have each experienced personal and professional growth through our engagement in this project in different but complementary arenas. We share common commitments and compatible though unique visions of the future.

Engaging in this retrospective and on-going analysis has given us a deeper and broader understanding of the multi-faceted nature of professional development. There may be conflicts and incompatible views among project participants that sometimes balance each other, or remain as issues in need of resolution. This work focuses on participants who have chosen to remain with the project for more than five years. Missing voices include those who left after a year or two, or who are relatively new to the project. However this work extends previous evaluations of the program that focused on changing teacher practice and improving student attitudes toward science (Beyerbach et al., 1995). It may be that the direction of Project SMART to support teacher research is another step in current professional development reform, but also a significant step in the larger dialog about teaching and the role of teachers in defining that conversation.

Epilogue

It has been three years since these articles have been written. All of the co-authors have continued their involvement in Project SMART, and in teacher-research. Beyerbach, Keen, Russo and Weber now co-direct Project

SMART. Action research is built into each team's expectations for their work on the project during the summer institute and academic year. The action research projects have become the core of the program evaluation. A website (<http://www.oswego.edu/~prosmart>) serves as a vehicle for sharing and professional dialogue. Teachers from diverse contexts including New York City, Syracuse and rural Oswego County participate in the institute. Beyerbach works in a Professional Development School where the school culture is shifting towards expecting and supporting teacher inquiry as an ongoing part of teachers' work. Keen is now a professor at the college where she teaches introduction to education and science education courses in which she integrates a group action research project. Russo facilitates a teacher-researcher group of graduate students seeking master's degrees as part of her work as a foundations professor. Weber is currently serving as the School of Education Associate Dean and the institutions NCATE coordinator where she seeks to build teacher research into the assessment plan of the School of Education Programs. Suskin is the senior teacher on Project SMART, having participated 13 years. She is a classroom teacher as well as an adjunct professor at SUNY Oswego. She builds in a teacher research component in the curriculum development project in her graduate course. With support from the project directors, the School of Education has developed a conceptual framework centered on teaching for social justice, and the project supports research and teaching in this area. All of the co-authors continue to challenge schools and the university to support the type of sustained teacher inquiry that can serve as a powerful vehicle for professional development.

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