Urban Education
Volume 44 Number 1
January 2009 88-105

10.1177/0042085908318527
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http://online.sagepub.com

Science Teacher Retention in Today's Urban Schools

A Study of Success and Failure

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This study is based on data collected during 6 years (12 semesters) in the secondary science methods courses at an urban university in Southern California. The secondary science credential candidates were teaching on emergency permits or internship credentials in local urban secondary schools. They taught science during the day and pursued their teaching licenses in the late afternoons. Power relationships, urbanity, and critical pedagogy lenses were critical in analyzing the data. Multiple data sources, such as the credential candidates' written assignments, verbal communications, and field notes during classroom observations, were triangulated. Findings suggest that secondary science interns tend to thrive in schools where there is a perceived cohesive vision regarding science education and where efforts of all the stakeholders in the educational community (teachers, students, administration, community, including parents, district personnel, university instructors, and the science education research community) are focused on reaching a common goal. However, efforts are wasted where there is no cohesion, and frustrated players in the educational community tend to blame each other for the lack of positive results. Implications of these situations for the interns' attitudes and actions are further explored.

Keywords: *science interns; power relationships; teaching science; urban classrooms*

Urban science education finds itself at a crossroads. The demand for competent science teachers, science-inclined citizens, and science understanding is increasing constantly (Darling-Hammond, 2001; National Research Council, 1996, 2000; Proweller & Mitchener, 2004). At the same

Author's Note: I want to acknowledge Leni Cook, Professor Emeritus of Teacher Education at California State University–Dominguez Hills, for her comments and suggestions on earlier versions of this article and for editorial support. Please address correspondence concerning this article to Hedy Moscovici, hmoscovici@csudh.edu.

time, we identified stories of success that focus on some of the pertinent problems with science education in urban schools, such as developing an assessment system that correlates with problem-based learning in the sciences (Marx et al., 2004); addressing sociocultural issues (Brown, 2004; Lee, 2004); finding elements that enhance the translation of inquiry science into the preservice science teachers' practicum (Windschitl, 2004); and fostering development and support of teachers who can provide high-quality instruction for their students (Weiss & Pasley, 2004).

Despite the success stories and the recommendations, urban science teaching and learning are still in jeopardy. Using a systematic approach, this study uncovers some of the problems experienced by science interns and attempts to provide recommendations for the improvement of urban science education. Data collected during 6 years from science methods courses and classroom observations served as the basis for the analyses. Multiple data sources in the form of credential candidates' written assignments, verbal communications, and field notes during classroom observations were used for the analyses. The results of the analyses are presented as three composite, or likely, stories (Barone, 1988): Latanya's story, Jim's story, and Maria's story, with a table that represents the elements defined by interns as essential for the implementation of inquiry science in the urban secondary classroom. Names and genders of participants were modified to ensure anonymity.

Theoretical Referents

Power Relations

In terms of power relationships and their influence on human action, the works of Yukl (1989) and Foucault (1979, 1980) were informative. Yukl (1989) defined power as follows:

> An agent's potential influence over the attitudes and behavior of one or more target persons. The focus of the definition is on influence over people, but control over things will be treated as one source of power. The agent is usually an individual, but occasionally it will be an organizational subunit. (p. 14)

Yukl's three categories of power—position, personal, and political—correspond to different sources. For example, position power includes power resulting from formal authority or "legitimate power," control over rewards, punishments, resources, information, and the physical environment (or "ecological control"). Personal power is described as the result of expertise, friendship/loyalty, and charisma. Political power is presented as the result of control over decision processes and the development of coalitions. The idea behind power relationships in classrooms is to increase awareness and learn how to share various sources of power to maximize students' learning. For example, instructors who decided to share their position power and expertise power (part of personal power) and created partnerships with their students in the area of political power increased students' learning and their degree of comfort with the subject (Moscovici, 2002, 2003).

Foucault (1979, 1980) emphasized the strong relationship between power and knowledge and the fact that one could not find a situation that is divorced from power relationships. He also underlined the fact that power is defined only in relational situations (with others and with objects) and that there are no situations in which power does not play an important role. Power relationships are dynamic social structures that orchestrate perceptions and actions in any given situation.

Urban Education and Critical Pedagogy

Much has been written on urban education. As most writings have a transformative intent, it seemed almost natural to combine urban education with critical pedagogy for the analyses. Some of the studies have a historical perspective (Cuban & Usdan, 2003; Rothstein, 1984). Most concentrate on urban educational systems and common "fault" for the lack of success and for finding solutions (Brown, 2003; Corbett, Wilson, & Williams, 2002; Hill & Celio, 1998; Rathbone, 1998; Rymes, 2001). Kretovics and Nussel (1994) prepared an extremely helpful collection of articles exploring various aspects of urban education, such as socioeconomic issues, learning styles, parent involvement, teacher characteristics, and others. There are no simple solutions as we face a system problem. Comer (1980) recognized the power that students have in a society that changes rapidly, especially because of their ability and curiosity toward technology. He recommended using this positive power in motivating students to learn while, at the same time, minimizing the negative power that looks at the students' lack of skills and employs the "defective" perspective. In *Urban Classroom Portraits: Teachers Who Make a Difference*, Bredemeier (1988) illustrated science learning (and other subjects) using secondary classrooms (and schools) from Newark, New Jersey. The general message is that enthusiastic teachers who tend to challenge their students and present science using an exploratory lens force their students to become active learners and producers of scientific knowledge.

Uncovering problems lends itself to taking action. The notion of teachers as transformative intellectuals (Aronowitz & Giroux, 1993; Giroux, 1994) who “need to educate students not only to make choices and think critically but also to believe that they can make a difference in the world” (Giroux, 1994, p. 407) is essential if we look at teachers’ and students’ roles in society. Freire (1998) supports the idea of the teacher as a critical professional and role model and through his 10 letters emphasizes the multiple complexities that are necessary to “dare” to teach.

There is a certain connection between the study of power relations and the infusion of ideas from the field of critical pedagogy into the urban classrooms. Stakeholders (as people/participants with vested interest, and who “are put at some risk by the evaluation” as defined by Guba & Lincoln, 1989, p. 201) need to feel empowered to question the status quo, offer suggestions, negotiate solutions, and act. There is a tremendous amount of knowledge and energy that could and should be focused on helping students think critically using science inquiry. Recognizing students’ positive sources of power (such as their expertise with using technology mentioned previously—source of personal power; see Yukl, 1989) and moving science teaching and learning forward using abilities and characteristics of the transformative intellectual (Aronowitz & Giroux, 1993; Giroux, 1994) have the potential to improve urban science education.

In this study, participants used elements of power relationships (Yukl, 1989) and literature on urban teaching (e.g., Brademeier, 1988) to describe their experiences in urban science classrooms while trying to infuse science inquiry into their practices and become transformative intellectuals.

Method

This study is based on data constructed during 6 years (12 semesters) of teaching science methods courses to secondary science credential candidates at an urban university, supervising science credential candidates during fieldwork, and working with science interns during in-service science institutes and follow-ups. More than 233 credential candidates participated in the study. Data collected from a variety of data sources included artifacts such as credential candidates’ written reactions to the science methods class topics (e.g., power relationships in their lives as teachers, professionalism), field notes during classroom observations (e.g., discourse analyses during clarifications, group interactions and learning, supervisor’s form), field notes and feedback surveys for science in-services (e.g., presenter’s questioning strategies, learned science topics during the in-service), and semistructured and informal interviews with participants. Data were framed and reframed on numerous occasions as recommended by Guba and Lincoln (1989) by means of a process called triangulation (Berg, 1989). This analysis process—triangulation—involves challenging the interpretation of the same event by the use of different perspectives and contrasting data that were constructed from different data sources in an attempt to verify interpretations and deepen our understanding of an event. Using Denzin's framework, which requires multiplicity in terms of data sources, data-collection procedures, theoretical perspectives, and/or analysis techniques, Berg (1989) defined triangulation as "the use of multiple lines of sight" (p. 4). According to Berg, triangulation results as follows:

> By combining several lines of sight, researchers obtain a better, more substantive picture of reality; a richer, more complete array of symbols and theoretical concepts; and a means of verifying many of these elements. The use of multiple lines of sight is frequently called *triangulation*. (p. 4)

Therefore, when and where there was a need for clarification, participants were asked to interpret or react to their statements, their peers' statements, or possible interpretations of various statements. These clarifications and additions helped with data reconstruction.

This paragraph describes how I used triangulation as my method of data analysis in defining and refining the different characteristics presented in Table 1. I use examples of using intern writings and personal classroom observations that led to the "Ability and comfort to think critically" under Student Characteristics. Excerpts from interns' writings include the following: "The kids don't think," "Students do not have the ability to think," "They [students] are not in the habit of thinking," "Don't think in science classrooms," "Complain about science class not being an English class where they need to write," and "Kids don't like to have to think and to do math in science classrooms." These are the different perspectives coming from the interns on the subject of students' ability to think critically and express their thinking in science classrooms. During classroom observations, I recorded conversations taking place in cooperative groups and/or side conversations that proved that students had the ability and comfort to think critically and find relationships. For example, when exploring the relationship between mass and volume and the concept of density, students predicted that by connecting two identical cubes, they would behave the same way as one cube when placed in water: "double the weight [mass], double the volume—same

Table 1
Translating Inquiry Science Into Secondary Science Classrooms: Necessary Elements/Characteristics and the Power Sources Involved[a]

Group	Main Power Sources (Yukl, 1989)
Student characteristics	
Ability and comfort to think critically	Personal (shared)
Enthusiasm for subject matter	Personal (shared)
Risk taker: “dropping in,” Rymes, 2001, p. 73 (students on the verge of “dropping out” or who “dropped out” who decided to learn from experience and take the risk involved in change and successfully “dropping in”)I	Personal (shared)
Understands and is able to use experimental design	Personal (shared)
Comfortable with providing and accepting constructive criticism with peers and teachers	Personal (shared)
Teaching credential candidate (intern) characteristics	
Enthusiasm for subject matter	Personal (shared)
Enthusiasm for teaching	Personal (shared)
High expectations from students	Personal (shared)
Knowledge of subject matter, including the nature of science	Personal (shared expertise)
Knowledge of pedagogy • Learning is based on previous knowledge • Learners need to be active participants • Appropriate scaffolding helps learners • Learners have different dispositions and needs (e.g., multiple intelligences, Specially Designed Academic Instruction in English technique for English language learners)	Personal (shared expertise)
Enthusiasm for learning (e.g., attending professional development activities, learning from students and peers)S	Personal (shared)
School characteristics	
Cohesive vision	Position (shared)
Open to parents and community members	Position (shared)
Clean and well kept	Position, personal, and political (shared)
Supportive for teacher, student, and parent empowerment	Political (shared)
Making sure that the number of students does not exceed the state recommendations in terms of safety	Position, personal, and political (shared)
Community characteristics	
Supportive—offering • In-kind (e.g., expertise, bus rides to educational sites) • Financial (e.g., internships, scholarships, money to purchase laboratory supplies)	Position, personal, and political (shared)

(continued)

Table 1 (continued)

Group	Main Power Sources (Yukl, 1989)
District characteristics	
Cohesive vision—some districts developed instructional guides emphasizing science inquiry	position, personal, and political (shared)
Supportive—providing expertise, classroom support (coaches), materials, and equipment	Position, personal, and political (shared)
Credential program characteristics	
Cohesive vision with school district and schools	Position, personal, and political (shared)
Supportive—providing materials and expertise for transferring ideas learned into the secondary science classroom	Position, personal, and political (shared)
State characteristics	
Align science state assessments with the shift toward science inquiry	Position, personal, and political (shared)
Support the creation and adoption of science texts and materials that emphasize science teaching and learning by means of inquiry methodology	Position, personal, and political (shared)
Provide the necessary funding that will allow scientific investigations to be safely implemented with appropriate materials and equipment	Position, personal, and political (shared)

a. Yukl's (1989) categories of power, or power sources: position, personal, and political.

result." The same kind of thinking took place in a group of high school biology students discussing the concept of the enzyme as a protein. Although they were supposed to plan and perform an experiment that would illustrate the role of temperature on enzymes, students in the group were considering experiments that would show the relationship between just manipulating the enzyme (exposing it to the air, the influence of containers, even the role of the pipette) and its activity on a substrate. Unfortunately, these arguments did not find their way into their written worksheets, where answers tended to be monosyllabic. Students tended to answer with "yes" or "no" where possible without making their thinking process visible to the intern science teacher. In the science methods class, I would address students' thinking (as observed) with interns' written statements, and using literature on the subject (as another source of evidence), try to teach interns how to make students' thinking visible and recognize students' ability to think as a power source (part of personal sources of power; Yukl, 1989). Data from the interns' writing was triangulated with data from observations, and interns' continuous feedback over the years, which resulted in the characteristics presented in Table 1.

Findings

Findings are presented using three composite narratives or stories (Latanya's, Jim's, and Maria's stories) and a table that summarizes the necessary elements for the translation of scientific investigations or inquiries from the science methods courses into secondary urban classrooms. The table evolved during the years. During the first years, I just recorded credential candidates' statements when they mentioned perceived difficulties or challenges in translating inquiry in their science classrooms. As more and more statements were added, I realized that some statements needed to be condensed into one as these addressed the same issue. I used the table as a tool to help interns think about ways to use what they have and overcome the lack of certain elements in their science teaching environment. Although the table looked at the elements needed for inquiry science to reach and be successful in urban secondary science classrooms, the stories evolved from the need to provide rich descriptions as to the interns' decisions to continue teaching or to leave the teaching profession. It is one thing to present the elements in a data table and quite another to provide stories analyzing how these elements interact in credential candidates' lives and lead them to make decisions regarding their future. Knowing that there were multiple stories for every statement, I had to combine stories and restrict the number to a manageable one representative of the variety of the credential candidates.

Story 1, Latanya's story, provides us with the perspective of the intern who tried different teaching positions and reached the conclusion that she could not reach the students and help them become inquirers in science classrooms. As she could not reach her goal alone and did not seem to find support at the school site, she is ready to leave teaching and return to her successful research career. Story 2, Jim's story, represents the position of the credential candidate who is ready to leave his teaching position and look for another teaching position that will support his talents and efforts. The reason Jim is not determined to leave the teaching profession is that because of his past work experience, he realizes that teaching in one context could vary tremendously from teaching in a different context. He attends conferences on science teaching and develops collegial relationships with other physics teachers all over the country.

In Story 3, Maria, who is also a secondary science intern, joins a strong science department in a local, urban middle school. She feels supported by the administration and the other teachers and enjoys teaching in her “old” school (she spent her middle school years in the same school). Twice a month, all the science teachers meet as a department and discuss science projects, culminating events, and ways to improve student behavior and interest in science and use the science results on the new district periodic assessment to improve teaching and learning. Maria’s experience and knowledge as a plant biologist are valued, and she feels that she belongs.

As mentioned earlier, Table 1 evolved, during the 6 years of the study, from my way of summarizing the elements needed for the translation of scientific inquiries into the interns’ classrooms to a critical tool used for science methods class discussions. On the same note, the study expanded its focus from the narrow classroom context (teachers, students, and classroom characteristics necessary for inquiry science) to the larger school, district, community, teacher credential program, and state environments. Interns realized that what they did in their science classrooms had an effect on the society outside the classroom, but then, elements of the larger society (e.g., administration, district personnel and documents, state mandates) also influenced the kind of science that entered their classroom.

Story 1: Why Is Latanya Ready to Leave Teaching and Return to Environmental Research?

Latanya is in her third year teaching as an intern in a local urban district. Before teaching, she was an environmental researcher working for a local firm on the effect of water runs on ocean flora and fauna. The results of her research were published, and her career was moving forward, when she realized that she mostly enjoyed sharing and discussing her results with teenagers in the area, especially surfers. That was when she decided to follow a teaching career. After her first year teaching, she moved from the middle school to a local high school, particularly because of the lack of support from colleagues and administration. In her second year at her high school, she became part of the veteran teachers’ workforce as most science teachers left after their first year. She teaches the AP environmental science class and five sections of 9th-grade integrated coordinated science (ICS). She was supposed to teach only four sections of ICS; however, because of the lack of science teachers, she was asked to teach on overload. Although she enjoys teaching the AP environmental class and she finds most students interested in the topic, she is very disappointed with her ICS classes.

> The students do not want to be there [in the ICS], and in most cases, neither do I. They do not seem to want to solve science puzzles, nor do they display interest to get involved in any form of thinking. Sitting down and socializing . . . that's what they want. That's "cool." Even when one student thinks and has answers, she prefers to pretend that she doesn't have a brain rather than take a risk and answer a thinking question or show any kind of interest or enthusiasm for science. I have a few of these in every class; however, they get swallowed into the "cool" social environment, where they need to pretend to be brainless for acceptance.
>
> As to my science peers, when I moved from the middle school, I was hoping to find a collaborative cadre of science teachers ready to embrace the newcomer. Instead, I found a disconnected group, if I can call this a group. Everyone for herself, that's the name of the battle, and by the end of the day, they evacuate the premises faster than the students. And if you miss the first department meeting, you end up [elected] the new chair of the science department, [whether] you have the skills and experience to do the job or not. So, here is your answer as to my qualifications and willingness to serve in my new position as chair of the science department. There is no time assigned to plan the science department meetings, nor are there any developed connections with the administration in terms of departmental budget. Money allocations seem to be based on likes and dislikes rather than needs, and it gets very hectic with yearly changes in administration. Even if I had the materials to do science experiments with my ICS classes, I couldn't do them because of safety. With 40 students in class and no laboratory setting, it would be plain dangerous.
>
> I've had enough of teaching to last me a lifetime. I will finish the program and then go back to scientific research, where my efforts are valued and where I am part of a group.

Latanya's experience in science research prepared her to look at the natural world with a questioning eye, collecting data and looking for patterns constantly. While talking with surfers about the effect of water runs on the ocean ecology, she found they were open to her ideas and findings as they were also interested in continuing surfing while keeping healthy. Her surprise came once she began teaching and found most students showing disinterest in science as a way to be "cool" or just being genuinely not interested in understanding science and its role in human life. The lack of support from her peers and administration in both schools made her a skeptic, questioning when other urban science interns in class would provide positive learning examples from their classrooms.

Story 2: Why Is Jim Ready to Move to Another School or to Leave the Profession?

Jim is an intern. For the past 5 years, he taught physics in a local urban high school. At the beginning, he was asked to teach general physics, and now he is mainly teaching the advanced placement and the honors physics classes.

> You cannot imagine the first years that I taught. The students were not motivated. The parents, when they showed up, encouraged the students by stating that the kids resembled them as they were not good with science or mathematics themselves. Any hands-on attempts were out of the question as there were no tables in the classroom and, combined with 45 students per class, it was not even safe. Every time I wanted the students to explore mathematical relationships, students reacted with "But it's not a math class," and when they had to read a few paragraphs, they complained that "we thought it was a physics class, and not an English one." You will not believe it, but they even thought that there were two different metric systems, one for math and one for science; of course, they did not seem to remember either one! Another interesting fact: All the universities and educational consultants in the world seemed to know what was wrong with our school and tried to fix the situation. The school, sometimes with support from the district, sent teams of two teachers to different workshops. Consultants came and showed a demo lesson. Unfortunately, there was no time to prepare and use the new ideas in the classrooms. It was like someone was placing an infinite number of patches, disregarding the cloth as a whole or even thinking about coordinating [the] patches. The school really looks like a circus. We are all confused and talking multiple languages according to the trainings that we attended. No cohesion, no understanding!

Jim's experience as a research engineer with a well-known firm prepared him to become an inquirer. He approached teaching believing that every student can learn if only given a chance. He employed his knowledge and excitement by having a problem-based curriculum in which students solved problems such as building a rocket that would fly a certain minimal distance or building an object that would slide on an inclined wire without tripping. During students' project time, Jim would questions students' decisions for design and provide them with pertinent reading materials and video clips. Physics principles, laws, and theories came to life during students' projects and led to successful projects and high test results.

Despite his affection for the students and his recognition of their potential and will to learn, Jim is waiting to move to another school once he receives his credential. He already asked Maria (a colleague in the science methods course) to inquire [whether] her school district needs or will need a physics teacher next year. When asked why he is thinking about moving to another school, he replied as follows:

> I am tired of fighting a system—other science teachers, who think that physics can be taught without equipment, materials, and even without tables ('If Alex—the teacher who just retired—could teach it, you can teach it too,' is the usual response) [and] without administrative support (how can a teacher use group work or even individual work that involves manipulation of equipment and data collection in a classroom without tables? And with over 40 students?); parents who seem not to care or who reinforce their kids' inability to cope with physics and math as being inherited traits; a district that does not support good science teaching with money and cohesive professional development; and a state that seems to correlate knowing physics with the ability to select correct responses on multiple-choice exams. It will be easier to join a team that already solved these issues (or at least some of these issues) and developed a cohesive vision regarding what students should know and be able to do by the time they graduate from middle or high school physics.

Story 3: Why Is Maria Happy to Go Teach Science Every Day?

Maria wanted to be in the traditional science teaching program. She has decided that it was worth taking time and not jumping into the science teaching "ocean" prior to getting her teaching credential. Her degree is in biology with an emphasis on plant anatomy and physiology. After finishing her degree, she worked for a number of years in a research laboratory looking for the chemical basis for plant response to light. "I felt too lonely in the research lab. I needed people to talk to and discuss ideas. That was what brought me into teaching." In her second semester of her credential program, she went for a job interview, feeling that she could not refuse going back to her middle school. On the same day, she got the job offer. "I just could not refuse. The middle school is the same one I attended as a student, and I know many of the teachers and the principal, who was a teacher when I was just a student in the same school. Most teachers live in the neighborhood, and I attended school with most of my students' parents. The offer was too good—I had to accept." Maria joined the middle school staff as she shifted from the traditional credential program into the alternative intern program.

Because her middle school is located in a low socioeconomic neighborhood, she experienced the invasion of science consultants and miracle programs (similar to Jim's experience). The site is also used by some research groups coming from "Research I" universities in the area who want "uncontaminated" groups of students for their research.

> We are really lucky having such strong administrative support and such a wonderful science chair. After research presentations or trainings, we [the science department] talk about what we have seen and what we think about the possibilities of the different ideas with our student population. As a group, we decide what to do. It really does not mean that you are going to see the same lesson presented by two different teachers using the same exact pathway. We, the teachers, have the flexibility to invent our own thing. Furthermore, we all have access and coordinate the equipment and materials that were given to workshop participants, provided by the district or by the research group. Actually, we have most of the same equipment and materials that are available in the laboratory where we meet for the science methods courses, and we can use them for the presentation to our peer interns prior to trying the inquiry lab in our classrooms.

Maria is concerned with the large number of students that she has in her middle school classes, and with the safety issues:

> Now that I know what is involved in science safety and the state recommendations, it is hard to understand why we do not have the facilities and the number of students that will allow us to successfully implement scientific inquiries in the middle school environment. With 35-45 students in every class, it is hard to safely do the things that I believe are necessary for the students to explore.

When asked about her future, Maria summarized as follows:

> I think I am going to stay and teach for a few years. I love the school, and I think I can help the students to come to love science the same way that I do. I know where they are coming from, and I can advise them on how to become what they want. It is just so exciting to do what you want to do and have such wonderful people to do it with. I am not feeling lonely like in the science research lab.

As mentioned earlier, Table 1 summarizes the ideas presented by the science interns who attended the author's science methods course for the past

6 years (12 semesters). It is interesting to underline the fact that although the table began with a classroom focus (student, teacher, and classroom characteristics), it evolved into a system approach, with stakeholders spreading from the classroom to school, community, district, university credential program, and state. Because *Inquiry and the National Science Education Standards* (National Research Council, 2000) is one of the science methods texts, it might be that the system approach of the text triggered the interns' approach to viewing the improvement of science teaching as a national effort—or even an international effort because another text that was used presented the international science education arena (Wallace & Louden, 2002).

It is interesting to observe that although the emphasis for the student and intern characteristics fall under the category of sharing personal power sources such as expertise, interns seem to prefer schools, school districts, and credential programs that share power sources with the stakeholders involved and build a cohesive vision regarding science education, a vision that is also supported by state policies.

Discussion and Conclusion

Urban science education continues to be an important issue at the national level. Based on the available literature and the results of this study, we (science interns, students, schools, principals, credentialing programs, etc.) need to collectively begin thinking of solutions using a system approach. Large cities need to get away from the disconnected patching approach and look for comprehensive and cohesive solutions. Hill and Celio (1998) stated it as follows:

> Big-city school systems like Los Angeles, Chicago, and Milwaukee are trying to give individual schools more control over teaching methods while at the same time issuing new mandates for multicultural education, diversity training, AIDS awareness, and recognition of students' different learning styles. Some city systems are mounting several different teacher training programs simultaneously, some aimed at training teachers in subjects where many are deficient, others aimed at convincing teachers that the only valid knowledge is what they formulate for themselves and their own students. None of these programs or processes is necessarily bad in itself, but a school or school district that pursues all of them at once will not get the benefit of any. (pp. 4-5)

Added to the list of trainings mentioned earlier might be all the science-related, activity-based professional developments, such as Full Option Science

System, Great Explorations in Math and Science, and Science Curriculum Improvement Study; programs with roots in cognitive psychology, such as Instrumental Enrichment and the materials from the Institute for Learning (University of Pittsburgh); and programs such as Lesson Study that emphasize the need for the teacher to be a reflective practitioner. Although each one of the programs mentioned has merits, when the school faculty gets training in more than one of these programs without the necessary time to discuss, reflect, and decide what and how to infuse ideas that were presented into their practices, training is a waste of time and resources.

Table 1 provides a comprehensive list of the elements that science interns found essential in the translation of the inquiry science practiced during the science methods courses into their own classrooms. It also provides a list of related power sources that contribute to the status quo. In essence, science teaching using inquiry methodologies will be successful when prepared students become engaged in science learning under the leadership of a well-prepared science teacher in a safe and well-supported environment. The support is going to involve elements from the school, community, district, credential program, and state, with all the participants sharing autonomy and responsibility for the end result: urban students who like science, know how to solve scientific inquiries, and understand the role of science in our society. Because the elements came from the different intern participants, there is no need to ensure that all are accounted for in order to find or expect the translation. Latanya and interns like her look for supportive science departments with teachers employing their personal and political sources of power and schools where “cool” is defined by students who are able to use their personal power and actively participate and think in science classrooms. For interns such as Jim, classroom equipment, as well as feeling supported by the administration, seem essential; without these, he is ready to leave his science teaching position. His perceived lack of power (with the exception of expertise) in his school environment pushes Jim to look for other employment. Maria is ready to use her expertise and her political and position powers and find safe science experiments that can be transformed into inquiries for her 35-45 students.

Quo Vadis Urban Science Education?

Interns realized that the way science enters their classrooms is the result of a myriad of elements and their interplay. Students, teachers, school and district administrators, teacher educators, scientists, and communities—including parents—are all stakeholders in the process of educating the future generation to love, use, and respect the principles and ideas of science. As we are all contributors, we need to take the responsibility to help reach this goal. As stakeholders, we all have a say and the responsibility to carry out decisions. There is no time to blame others.

Brown (2003), who looked at the improvement of education by using a critical system approach that goes beyond the more defined elements discussed in this paper and addresses the political arena, said it best:

> Is it possible that we are all to blame for its [reform] shortsightedness and lack of perspective? Is it possible that, given such a contentious and diverse population and such preposterous ideas and such a maddening contradictory political and economic system and such a history of ambivalence about the young and such a history of penny pinching when it comes to investing in the young, America has about as good an education system as could reasonably be expected? Is it possible that, in the circumstances, we are all getting pretty much what we want and what we deserve?
>
> There. I feel better now. (p. 112)

In an effort to respond to Brown's call and be able to use a systemic approach to science intern retention in urban schools, I joined a cooperative effort that brings together representatives from multiple university preservice secondary science programs and departments (faculty and administrators involved in interns' science as well as education coursework) and from a local urban school district (administrators and teachers). The goal of the collaboration is to build cohesiveness among university programs and school, district, and state requirements and initiatives that will ensure the kind of science teaching and learning recommended by national documents such as the *National Science Education Standards* (National Research Council, 1996), *Inquiry and the National Science Education Standards* (National Research Council, 2000), *Science for All Americans* (Rutherford & Ahlgren, 1990), and *Inquiring into Inquiry Learning and Teaching in Science* (Minstrell & van Zee, 2000), to mention only a few. Such an approach and a clear focus on urban science intern-stated challenges (see Table 1) and power relationships and their dynamic nature (Foucault, 1979, 1980; Moscovici, 2002, 2003; Yukl, 1989) could have an effect on urban science teacher retention. As we are at the beginning of this collaborative project, this study will continue, with Part II focusing on reporting on the effect of the collaboration on science interns' retention.

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