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The Use of Urban Students' Photographs as a Data Source and the Complexity of Their Elementary Teachers' Interpretations

John Settlage
The University of Connecticut

Photographs taken by urban students, along with the associated interview transcripts, were provided to their teachers partway through the subsequent school year. The teachers were prompted to describe their impressions of the photos relative to their knowledge of the students. In addition, the teachers were asked how these insights might shape their instructional practices. The photographs proved to be informative to the teachers, and they were able to propose changes in practices for individual students. Unfortunately, they were unable to articulate changes that might make the curriculum more culturally responsive for the students.

Introduction

Making explicit connections between the students' lives and the school curriculum is a persistent concern for the effective urban teacher (Haberman, 1992). Connection making does not represent a problem an urban teacher can ever entirely master; rather, it is a challenge to which continual attention must be paid. Addressing this tension becomes an essential dimension of quality instruction in urban classrooms. Au and Kawakami (1994) speculated that the mismatch between the classroom and students' home culture explains the historically poor academic performance of minority children. They propose that schools need to make the curriculum and the manner in which it is enacted culturally congruent with the students' home environments.

A common tendency in American education is to regard students from non-mainstream populations as disadvantaged, often resulting in a deficit mindset that contaminates teachers' interactions with their students (McIntyre, Rosebery, & González, 2001). Viewing nonwhite and/or low-income students as inherently defective may be a deliberate and conscious choice by some educators, but I would advocate that this mentality is most often a consequence of ignorance on the part of educators. To be certain, there is evidence that there are policies that indicate that my opinion is naïve; the increased pattern of segregation in public schools is disturbingly clear in its effects, if not in its insidious agenda (Clotfelter, 1999; Orfield & Eaton, 1996). To suggest that most teachers engage in deliberately harmful actions, however, portrays them in the very deficit mode that we find so offensive in others.

This study sought to explore urban teachers' decisionmaking when supplied with insights about their students. While in third grade, 24 students participated

in a photography project, and these photographs, along with transcripts of the individual interviews about the photos, were provided to their respective fourth-grade teachers. All of the children except for one were African American and all had English as their sole language at school and at home. The teachers were then interviewed to determine their interpretations of their students' work as well as to evaluate whether these insights would prompt them to adjust their instructional practices.

Science Teaching and Diversity Issues

Teaching science to diverse populations is an inherent component of science education, and it is a central aspect of the American Association for the Advancement of Science's (AAAS) Project 2061 reform agenda (AAAS, 1990); however, the specifics of curriculum design and instructional implementation as it relates to teaching diverse student populations remains largely uncharted territory within science education. In their report about teacher preparation issues, Wilson, Floden, and Ferrini-Mundy (2001) identified the issue of the gaps between the backgrounds of teachers compared to that of their students as highly pertinent and problematic:

> As the population of U.S. school-age children becomes increasingly more diverse, our pool of potential teachers remains less so. We need to consider policies that increase the diversity of the teacher pool, and we need to prepare all teachers to teach children whose backgrounds are different than their own. Researchers have had little opportunity to investigate the implications of this shift in students and their teachers, and while a question concerning the preparation of teachers to teach diverse students was not a focal one in this review, we argue (in our recommendations for future research) that *it ought to be central in the next generation of research on teacher preparation.* (emphasis added, p. 6)

Indeed, efforts have been undertaken to examine the challenges of science teacher preparation and development where the teachers are members of the dominant culture while their students are not (Howes, 2002; Moscovici, 2003; Parsons, 2003). The impression one develops from this line of research, despite the conscientious efforts of the researchers, is that it is still in its infancy. This is not to suggest that any single study is likely to overcome all the uncertainties nor to provide universal pronouncements about how to "fix" urban science teaching. Yet, as we join together as a research community, science educators are following the path described by Cochran-Smith (1995a) wherein we build our understandings even as we press forward with our immediate obligations and incomplete knowledge.

Teaching in Urban Schools

The difference in backgrounds between teachers and students within a school is more than a demographic curiosity—the differences manifest themselves in the moment-to-moment decisionmaking characterizing teaching and pervading the very pulse and tone of the school day. The "common sense" notion that teaching well is independent of the context within which it occurs is a false proposition.

Knowing the content and being able to transmit that information to students is more than just skilled performance.

Few educators would endorse the suggestion that effective teaching is simply a matter of mastering particular teaching techniques—the content being delivered is at least as important. Similarly, content mastery does not a great teacher make: Knowledge of examples, analogies, and illustrations that allow the material to be comprehensible is vital if a teacher is to be effective with his or her students. The unique blend of subject area mastery and making that subject accessible to an audience falls within the realm of pedagogical content knowledge (Shulman, 1986), and being able to adjust instruction to the background, interests, and learning styles of a particular classroom of students falls within this realm of teacher knowledge.

Meadows (1997) describes using real-world examples to make the ideas of kinetic and potential energy more concrete for urban high school students. Drawing upon his own experiences in nature, he attempted to use a waterfall as his analogy. At the top, the water has great potential but little kinetic energy. As the water cascades downward, potential energy reduces as the kinetic energy of the water increases. The students in whose classroom he was guest teaching were perplexed: None had experienced a waterfall and the explanation was completely ineffective. The pedagogical content knowledge that had served him so well in suburban science classrooms proved insufficient in an urban setting.

The wider the gap between the culture of teachers and the students with whom they work, the greater the likelihood that learning will be compromised. This does not accurately translate into the corollary that the absence of cultural gaps between teachers and students ensures better relationships. Nevertheless, whenever there are substantial differences between an instructor and their students in the communication styles, personal background, life experiences, and cultural norms, the educative process is certain to be less straightforward than in a situation where there is greater alignment between teacher and pupil.

In the "Teacher Survey on Professional Development and Training" (NCES, 2001), the U.S. Department of Education inquired about teachers' sense of preparedness to deal with various classroom activities: maintaining order, implementing innovative teaching strategies, meeting the needs of students with disabilities, and so on. Less than one-third of teachers surveyed indicated that they felt well-prepared to work with students of limited English proficiency or from diverse cultural backgrounds. Teachers feel inadequately prepared to work with ethnic minorities and students for whom English is a new language. There are indications that this discomfort can translate into less than ideal teaching practices. Metz (1998) compared a variety of schools and found that, of the gaps between teachers and students, the more striking factors included the quality and amount of instructional materials, administrative leadership style, and teacher dispositions toward the student body. Even though her study was of urban secondary schools, the stories she relates have parallels with elementary schools:

> When there was a disjunction in values and behaviors between what teachers felt it was right to encourage students to do and what students brought into the school or did outside it as teachers perceived it, teachers tended to feel alienated from students and students from them. Where there was a greater feeling of harmony, students and teachers had more energy to work together. (p. 25)

The types of disjunctions between teachers and students vary from district to district and exhibit variation across schools within districts. For urban districts in particular, the setting in which the current study took place, these differences are substantial. Nationally, students in urban schools have lower socioeconomic status (30% at or below poverty levels), have communication problems (9% have difficulty speaking English), and are largely nonwhite (32% black and 20% Hispanic)—demographic characteristics that separate the students from the majority of teachers working in urban schools (Office of Educational Research and Improvement, 1996). Such differences do not automatically create insurmountable barriers between teachers and students; however, the cultural norms within which these two populations operate do provide the potential for miscommunication and misunderstanding. When the disjunction is large, the alienation and disharmony identified by Metz (1998) contributes to a compromised educational system.

Methods

Using photographs as data has enjoyed a faint but lengthy tradition outside of educational research. Some approaches might seem less academic but are nonetheless very revealing. Wendy Ewald (2001) has relied upon children from around the world as they use cameras as tools for self-expression. More scholarly uses of photographs as data have existed within fields such as visual anthropology (Collier & Collier, 1986), and photographs can serve as a legitimate form of qualitative research (Harper, 1998; Prosser, 1998). The use of photographs as an information source within inquiries about classrooms is less widespread.

It has been increasingly common within the science education community for university-based researchers to maintain professional contact with the realities of the classroom. Even without a systematic study of such endeavors, it seems reasonable to suspect that these undertakings are largely a personal quest: Neither institutions of higher education nor the educational research community hold more than a passing regarding for the activity "as social activism, or as altruism, or as a gesture of good faith toward the profession at large" (Huberman, 1993, p. 51). In my case, I was preparing future teachers for elementary school positions and part of their required field experiences involved urban classrooms—a setting in which I had never taught. In addition, the state had recently instituted mandated testing in science across grade levels. It seemed a professional responsibility, if not an educational imperative, that I have firsthand experiences in the very settings for which I was preparing my preservice teachers.

After nearly a year team teaching science in an urban third-grade classroom, I wanted to assess the influences my teaching methods may have had upon the students. Fortuitously, I stumbled upon a modest study in which children documented their views of science through photography (Naizer, 1997). As a culminating event for the academic year, I provided my third graders with single-use cameras and asked them to take photographs around their homes of science as well as a few photographs of things that were of personal significance (we called these the "pictures about me"). The process of having the subjects of a research study take photographs and then using those photos as data has been dubbed "autophotography" (Ziller, 1990). Double prints were made (one set for me; the other for the creators), and I had individual conversations with the children about their photographs which I audiotaped. The interested reader can consult the details of this endeavor in the *Electronic Journal of Science Education* (Settlage, 2000). The photographs and interviews, along with other experiences in that classroom

(Settlage, 2002), enlightened my views about science education and urban schools . . . and made me wonder if other teachers would have similar reactions.

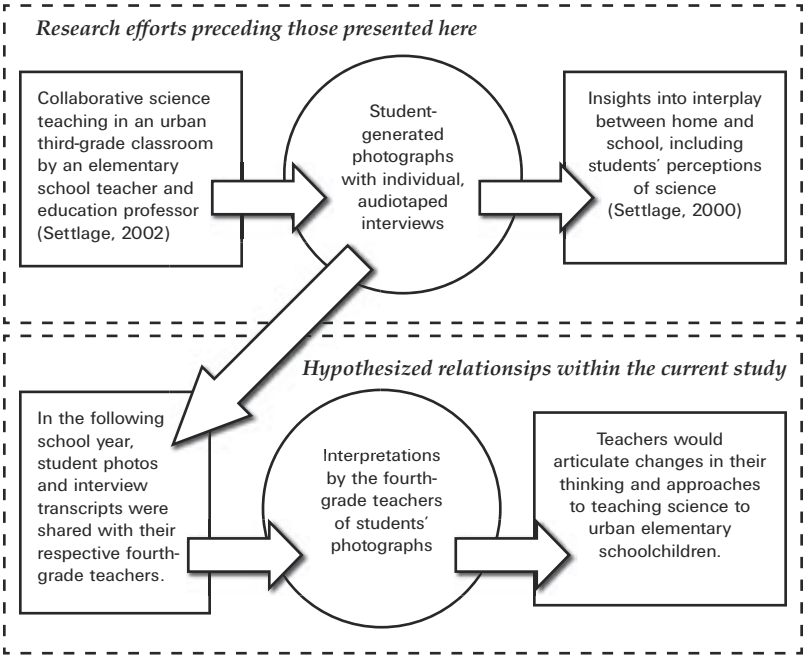
Conceptual Framework

No study begins out of nothing: There's always something that came before which, in subtle or substantial ways, shapes what comes after. The conceptual framework for this study is presented as Figure 1. In this framework, I am representing the experiences and events that preceded and informed the study presented here. As indicated in the preceding section, I had spent much of a school year team-teaching science in a third-grade classroom, a practice that I was to continue over four years. One impetus for that undertaking was to develop firsthand exposure to the sorts of settings that the elementary education majors who attend my science methods course would be experiencing. In an effort to somehow capture the effects of my efforts near the end of that first year, I had the students take photographs of their scientific and personal worlds. These data gave me considerable insights into the ways in which the children were connecting school-based science with their everyday lives while also showing potential disconnects between the science curriculum and the students. This collection of activities and insights is represented along the top of Figure 1.

The data for this study were the interviews of urban fourth-grade teachers. The teachers were interviewed in their classrooms at the end of a school day, and the focus of the interview was the meaning they were able to make about the photographs their students had taken during the previous school year. The components of the previous photographic study and their relationship to the study presented here appear as a conceptual framework in Figure 1.

The photography assignment was repeated at the end of my second year at this school. Once again I gained insights into the students' thoughts about how science connected with their home lives. In addition, having prompted the students to take some photographs that were autobiographical, my views of the children extended beyond their scientific worldviews. As a culminating activity at the end of the school year, I learned a great deal about my students although not in a way that would influence my subsequent teaching of that particular group. I wondered how my approach to science teaching would have been different had I the benefit of the students' photographs earlier in the year. That question led to this study, and my hunches about the effects of the photographs are represented in the bottom half of the conceptual framework.

Figure 1. Conceptual Framework Shaping the Design of This Study



Research Questions

The goal of this study was to investigate the interpretations fourth-grade teachers would make of the photographs made by their students during the previous year and to explore the possible implications that this knowledge would have upon their classroom practices (see bottom half of Figure 1). This goal took the form of two research questions:

1. What meaning do teachers ascribe to the student photographs: confirmations of their views of the students, revelations that are surprising, or other insights about the children as revealed through their photographs?

2. How might the information about the students (i.e., photographs plus interview transcripts) influence science teaching practices and curricular decisions?

Research Participants

The school in which I was working had very low turnover in students so most third graders attended the same building for fourth-grade. Having been a sufficient presence in the building to have developed some credibility and level of trust with many of the faculty, I approached the fourth-grade teachers with a proposition: Would they be willing to look at their students' photographs and interview transcripts and share with me their interpretations. In exchange, I

would teach three science lessons in their classroom dealing with the process skill of classification, a topic for which student performance was perennially low on the standardized test. Their responses, which were also audiotaped, served as the data for the study reported here.

One of the fourth-grade teachers declined to participate because he was not willing to be audiotaped; his students received the classification science lessons anyway. The remaining four fourth-grade teachers were white (as is the author) and had between one and three years of teaching experience within the Cleveland (Ohio) Municipal School District. The youthfulness of this group was a result of the statewide standardized testing: Results of the fourth-grade test are used to compare buildings and school districts, and scores with relative rankings were disseminated far and wide. Individual student scores were not used to determine promotion to the next grade level and, as a result, did not represent high stakes testing for the children. Given that most elementary buildings in the district were K-5 and only the fourth-grade test results were used to evaluate individual schools, the students' performance served as high-stakes pressures for the principals, and by extension the fourth-grade teachers. Inevitably, vacancies at the fourth-grade level were more prevalent than for any other elementary grade as more senior teachers opted for less intensely scrutinized grade levels. The fourth-grade teachers knew theirs were the most scrutinized classrooms and that the more veteran teachers were relieved because they were relatively free of such pressures by teaching at other grade levels.

The fourth-grade teachers were well-regarded by the other faculty in the building. More than merely acknowledging the pressures they experienced as the most publicly accountable team, these teachers were regarded as industrious, compassionate, and collaborative professionals. Their classroom management abilities were comparable to the veteran teachers and they were typically the first to arrive and the last to depart. This is not to suggest that these teachers were perfect, but at the same time, these four were viewed as an integral part of the faculty.

Data Analysis

Students had been given two tasks to structure their picture taking. First, they were to take photographs of themselves doing science. In a previous year, we instructed them to take photographs OF science. The consequence was that most of the science photographs showed objects of science (e.g., rocks, clouds, and plants) but rarely included the actions of science. To uncover the students' views about their abilities to engage in science, for this study their prompt was changed to encourage the representation of their active involvement in science activities. The second task was for the students to "take pictures about me" in which they were to represent something about themselves. This allowed the students to reveal in their photographs features about themselves as non-science individuals.

The interviews with the students about their photographs were also quite simple, at least on the surface. Each child was given his or her photographs on a Friday afternoon near the end of the school day. With the second set of prints, they were individually interviewed about the photos. The interview protocol was nothing more than "tell me what you're showing in these picture" with follow-up questions to clarify their intended meanings. Thus, the information provided to the teachers were the children's photographs along with the verbatim transcripts

of the individual interviews with the photographs keyed to the particular portions of the transcript.

The teacher interviews were transcribed and then examined for common patterns as well as for any exceptional comments (Miles & Huberman, 1994). The categories that emerged were then used as a framework for guiding interpretations upon subsequent re-readings of the transcripts. These ideas were used to create the text that appears in the "Results" section of this document. The authenticity of this analysis was determined by sharing the analysis with the participant teachers with the request that they consider whether the interpretations were accurate. They confirmed the authenticity of the analysis.

A key expectation was that the teachers would discover previously unknown insights about the students. Home visits were no longer practiced in this district, so the contact that teachers had with the students' families were mainly through twice yearly conferences and occasional telephone conversations. In our examination of the students' photographs in the previous year, my third-grade team teacher and I were struck by the number of students living in single-family houses. The stereotype of urban students living in apartments or public housing failed when we looked at the students' photographs. It was expected that similar mismatches would occur as the fourth-grade teachers inspected the students' photographs. Consequently, I had anticipated that the photographs would instill a higher regard for the students' home lives than the teachers might initially hold.

The students' photographs revealed their ability to create and document assorted scientific investigations, with some based upon activities performed in class and others of their own design. The first time I had used photographs with children, I was seeking evidence that the science we did at school had relevance and significance for the students in their nonschool lives. By and large, this proved to be true. Without the photographs, however, I would have been left uncertain as to the influence of science instruction beyond the classroom. This experience led me to expect that the fourth-grade teachers would also discover that science for their students is more than their school studies.

This combination of expectations (improved regard for students and heightened awareness of the significance of science) was expected to be a catalyst to the fourth-grade teachers for reconsidering their classroom practices. To a person, the teachers were sensitive to the individual students and, as was confirmed during the interviews, had much more comprehensive knowledge about their students than I had gained in my twice weekly science lessons. Given these dispositions, it was anticipated that the teachers would to varying degrees be able to identify ways in which they would change their teaching in response to their interpretations of the photographs; this was seen as the venue in which culturally relevant teaching (Gay, 2000) might come to the surface.

Results

Four of the five fourth-grade teachers were willing to participate in audiotaped interviews about the students and their photographs. The interviews were held in the teachers' classrooms after the students had left for the day. During each conversation, the original photographs and the transcripts of the child interviews were on hand and frequently consulted. The interview was structured around the research questions with the first being asked of each student and then the second being asked of the students as a group. The teachers commented favorably about the knowledge demonstrated and the skill the children invested

in the photographs. Ms. James noted that her students responded very well to the photography assignment: "They wanted to take the pictures to show who they are, or about them . . . especially Angela—she really just wanted to share about her."

One of Gary's photographs was of his third-grade teacher's desk and, during our conversation while he was a third grader, he explained that he wanted to take a photograph of the supplies. The author had been unable to derive a clear interpretation of this particular photograph and had wondered to himself if it was one of the occasionally inadvertent photographs. His fourth-grade teacher was able to make better sense of the photo: "He talks about Ms. Urry to me. Still. And he will say, 'We did this with Ms. Urry last year.' So you could tell he really liked Ms. Urry. I think he wanted to get some pictures of something of hers." Mrs. Mailer went on to suppose that Gary, unlike his classmate Yolanda, who did take a photograph of Ms. Urry, was too shy or too cool to ask his teacher if he could photograph her; the photo of his third-grade teacher's desktop covered with supplies was symbolic of who she was and represented something that made him feel good about himself.

Photos that Corroborated

In talking about Yolanda, Mrs. Mailer was highly complimentary, and the photos substantiated her perceptions of this student. Referring to Yolanda's photographs, Mrs. Mailer reported, "She has a solid family life. . . . I could tell that from her pictures. Her home life is what she took a lot of pictures of." Her teacher also noted that Yolanda's high regard for her school and the teachers who worked there was revealed in the photos: "I see that she took a picture of Ms. Urry and you and right there. To me, that says that she not only respects her family, but also the people who teach her." From her teacher's vantage point, the photographs and the Yolanda that Mrs. Mailer knew were consistent with each other.

In a somewhat similar fashion, Mrs. Mailer felt that Gary's photographs accurately reflected that child. She indicated that Gary was not a very organized student and sometimes unkempt; she noted that the grass in Gary's yard was in need of mowing. To his teacher, the student and his home were similar: "None of it's unclean; it's just kind of cluttered." These comments were not made in a derogatory tone. The teacher simply felt Gary was a little less orderly than some of his classmates, and the photographs of his home reinforced that perception.

Mr. Romansky saw Kim as a very no-nonsense, businesslike student who is very intent upon her academic performance. She is organized as a student, and this view was consistent with the appearance of her home, inside and out. The photographs that Kim took to show who she was represented the same individual that Mr. Romansky seemed to know. One photo in the category "about me" showed Kim reading a book, to which Mr. Romansky said,

> I can see Kim doing a lot of reading; she does things on her own just to do them. Today, we talked about living things, and Kim decided she was going to write some paragraphs about it. I didn't ask her to do it, but she did. And in it she reported all the information we were going over. So, I'm not at all surprised by Kim's pictures.

In much the same way, Ms. Garibaldi saw Audrey's photograph of herself reading as a fair representation of this child: "Not everyone is going to show you reading or writing, so she's kind of into school." Those children who chose to have

photographs taken of themselves preparing for school (e.g., filling their book bag, brushing their teeth, reading a book) were seen by their teachers as good students; that they took such photographs was considered reasonable by their teachers.

Most of the time the teachers reported the photographs accurately represented their perspectives about the children. There were instances, however, in which the students, their homes, and their attitudes were at variance with what the teachers felt they knew about the children. The next section describes those situations.

Photos Prompting Surprise

On a few occasions, the teachers noted how the place where the child lived was much different from what they had imagined. For example, although her teacher, Mrs. Mailer, expressed surprise by the landscaping around Yolanda's house, she also stated that this apparent care and attention was consistent with her perception of her family. In responding to the interviewer's comment about the manicured lawn and neat plantings, the teacher said, "I noticed that too, because I thought 'Wow, this looks like a nice neighborhood or a nice house.' . . . And I did notice that about Yolanda and I just think it shows you what kind of family she has."

Later in the conversation, Mrs. Mailer reiterated that even though she knew of Yolanda's family's commitment to their children's education (e.g., Yolanda brought a check from home each time book orders were distributed), she was still somewhat surprised by the appearance of the house: "She has a double-sized bed and everything was nice and she had nice comforters and things like that." In this instance, it seems the photographs revealed a more positive view of this child and her daily life than her teacher had imagined. The teacher had only good things to say about the initiative of Yolanda and her parents' interest in her success in school. Nevertheless, the photos of Yolanda's home reinforced and extended these notions.

Ms. James also related how the photographs of one of her students were pleasantly surprising to her. In describing Marisa, she said, "Her desk is always a disaster area. She's very disorganized and so I expected her to come from a home that is extremely disorganized"; however, her teacher noted several elements of Marisa's home that contrasted with her school personality: "I noticed that the household, like the plants: very neat and orderly. The aquarium's nice and clean. Even the fan is nice and clean." The teacher had somehow thought that Marisa's disorderliness had roots somehow in her home. This was not the case.

Later in the conversation, Ms. James noted another revelation about Marisa. The interviewer had remarked about the colorfulness of the clothes in Marisa's closet because he typically saw the children dressed in their school uniforms (white or light blue shirts and dark blue pants, skirts, or jumpers). Ms. James responded, saying, "That was another thing. I remember looking at that thinking: 'These are all dresses.' Marisa never ever wears dresses; she rarely even wears uniforms with skirts. She more often wears pants. So almost masculine the way she dresses. And then to see all these frills and flowers and pink." Although these insights might not be on the caliber of a paradigm shift, the photographs did give the teacher a glimpse of an individual not completely apparent to this adult.

In reacting to Gary's photographs of a science experiment he conducted at home, Mrs. Mailer was somewhat surprised by what she saw. Gary chose to take a series of photographs over several days to document the evaporation of water. About the photos, Mrs. Mailer remarked, "I was surprised actually that he took the time and did this at home. You know, I was just surprised. I didn't know that

he would, um, like in school he's real good about his schoolwork but when he's at home I didn't think that he'd be the one to get down on his knees and take consecutive photographs of the bowl. And he knew the word evaporation and different things like that. So that was surprising that he actually took the time to do all that." Recall that Gary was the student Mrs. Mailer perceived to be disorganized. This photographic series revealed a more studious and persistent child than his teacher had come to know. This is an instance in which photographs conferred positive insights about a student.

The surprises the photographs elicited in the teachers were not always positive. As Mr. Romansky discussed the students' photographs, he spoke extensively about the mismatch between what he thought he knew about a particular student and what he saw portrayed in the photographs. (Jacob was only one of two white children in the third-grade class, and the other child did not enroll at Frederick Douglass for fourth grade.) Several photographs by Jacob showed the interior of his home, and Mr. Romansky was troubled by what he read into those images. Mr. Romansky related that Jacob was the brightest student who had been in his class over the past three years:

> Yet I look through the pictures and I look at his home, and it kind of shook me up a bit. Pictures of the bedroom: not fully painted, many holes in the wall, ripped posters on the wall. The living room: ripped furniture, carpeting with multiple stains, pillows on the floor, stuff scattered. Doesn't strike me as—it was certainly not what I was expecting.

In general, the homes appearing in the children's photographs were neat and clean. Mr. Romansky's response to Jacob's photographs could simply be because the child appeared to be so well cared for yet the interior of his home showed signs of neglect. The intensity of Mr. Romansky's response might be attributable to the fact that the teacher and student had common ethnic backgrounds. Would this teacher have been as struck by the photos if they had been made by a non-white student? Perhaps, but it does raise the possibility that similarities and differences between children's and teachers' backgrounds are a factor worth considering.

Influences Upon Teaching

Most of the time when the teachers were asked to speculate how they might adjust their instruction in response to the insights provided by the student photographs, they had difficulty articulating a response. Perhaps by even asking such a question, the researcher implied the teacher had not been doing all they could to teach the students well. To suggest that there might have been more, better, and/or different strategies that the teachers could use in response to the photographs may have been an unintended slight or criticism of these young teachers' hard work. No doubt they felt as if they were doing almost all they could to provide for the intellectual, emotional, and social needs of these children; asking if the photographs might prompt them to explore alternatives might have been perceived as a form of disapproval. This reaction might be a reaction of the feedback they had grown accustomed to receiving from the building administrators.

Talking about Gary's series of photographs of evaporation, Mrs. Mailer realized she may have misjudged his ability to function with less structure: "I see that he planned this [experiment] and maybe with him I can make [class assignments]

more independent for him cause he can do it independently without much guidance." These remarks were based upon her observations that Gary was apparently quite capable of deciding upon a scientific question and seeking a way to answer and photographically document that inquiry. From the collection of photographs, Mrs. Mailer indicated that she ought to provide Gary with more challenging work while providing him with greater independence in deciding how to accomplish tasks.

Similarly, Audrey's teacher felt the photographs revealed a child who had greater capabilities than had been recognized in the classroom. Audrey's science photographs showed a range of activities (inducing a fork to become magnetic; investigating the melting and freezing of water), and a photo sequence was used to record each activity. Although her teacher knew that Audrey was quick to understand concepts, she explained that the photographs hinted that the student could handle less direction from the teacher. When asked to describe how she might adjust her teaching strategies with Audrey, Ms. Garibaldi said,

> She [Audrey] likes a lot of direction and kind of hears how to do it—maybe encourage her more to maybe do more on her own. You know, kind of help her maybe pick a topic and then say, "Well, you go and see, what you could do with that. What kind of experiment could you do?" Instead of just, "Here is one for you to do." Cause I know she can follow it; I know that she'll do it well. But maybe give her a little more interest in doing it on her own.

It was difficult to prompt the teachers to express strategies they might try with the children in response to the information gleaned from the photographs. The teachers may suffer from the inability to reflect upon their practices beyond a technical view of their work (van Manen, 1977). There were a few instances when teachers proposed changes in pedagogy or curriculum in response to the photographs. Mr. Romansky was the most senior teacher of the fourth-grade staff. He had begun his teaching career two years earlier by taking a position halfway through the school year. The other three participating teachers were all teaching fourth grade in this urban school district for the first time. Still trying to establish themselves and wrestling with the myriad demands placed upon them, these teachers might be a few years away from being able to step back from the practices and propose alternative strategies.

Conclusion

The purpose of this study was to examine teachers' reactions and interpretations of the photographs their students had taken. The first research question focused on how the photographs confirmed, revealed, or shaped the teachers' views of the students. The teachers' comments revealed a mixed response: Some elevated their opinions of the students; some found that the photographs reinforced their perceptions of the children; and some found that the photographs contradicted what they had thought about the child or their home life. Without going so far as to suggest the photographs provided startling and fresh information about the students for the teachers, it would be accurate to claim that the photographs often served as another piece of data that informed the teachers' overall perspectives of individual children.

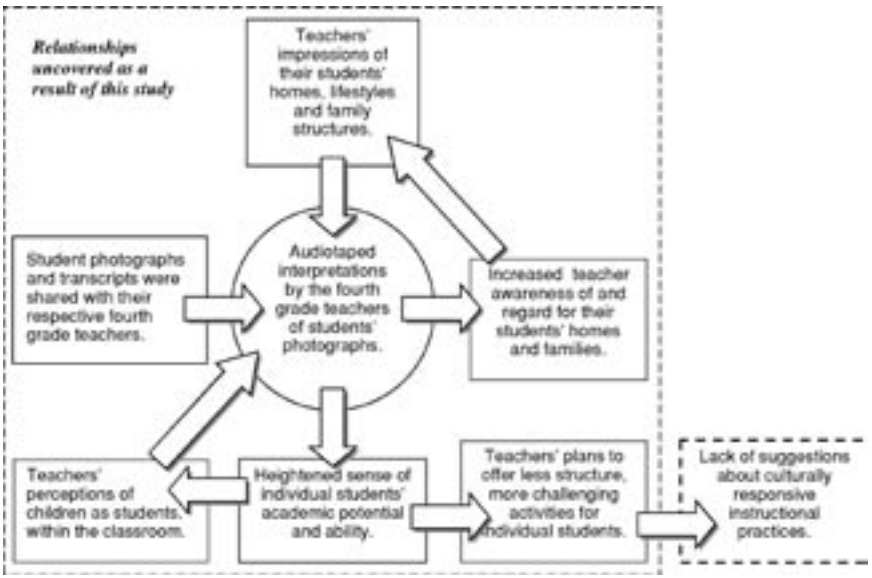
The second research question focused upon anticipated shifts in teachers' practices: Would the photographs promote more culturally responsive approaches

to instruction (Villegas, 1994). Although the teachers indicated that for some students the photos would prompt them to raise their expectations, often in the form of giving less structured assignments, the teachers showed no inclination to reform their instruction to better accommodate the cultural diversity of their students.

As has been revealed by many educators, becoming aware of cultural diversity and then seeking ways to make one's teaching resonant is an individual project that is dynamic and sporadic (Cochran-Smith, 1995b; Howard, 1999). For those academics bold enough to test multicultural theories in the resplendent confusion of schools, we become increasingly aware of the complexities of urban schooling. In a somewhat characteristically winsome manner, this study began with the expectation that increased urban teachers' awareness of their students via photographs would contribute to a sudden realization that their teaching practices must be questioned. While the data of the children's photographs did prove informative for the teachers, it cannot be claimed that their decisionmaking will become any more culturally resonant. The most defensible explanation for this finding is that the teachers were relative novices to urban education and lacked the depth of professional experience that would allow them to be critically reflective of their current practices.

The almost linear initial conceptual framework for this study needed dramatic reconfiguration. Rather than the stepwise pathway from photographs to culturally responsive pedagogy, the conceptual framework portrayed as Figure 2 is a much more authentic representation of the situation. That the box for culturally responsive pedagogy has a broken border and is outside of the frame indicates its lack of connection to the teacher interpretations.

Figure 2. Conceptual Framework Revised in Response to the Teacher interview Data



Implications

Moving teachers in urban settings to adopt more culturally responsive approaches to science instruction parallels more large-scale efforts to transform teacher practices. The NSF Urban Systemic Initiatives have had a difficult time with demonstrating measurable effects upon science instruction. The influence of professional development offerings (i.e., bolstering content knowledge, implementing new curricula, various methods for assessing students, and new instructional strategies) upon teaching practices has been virtually nonexistent. Comparisons of teachers who had more than 16 hours of professional development against those who had less than this amount proved to have negligible effects in terms of students' use of scientific equipment, data gathering, changing variables to determine the effects, formulating hypotheses or predictions, representing data in graphical forms, or drawing conclusions (Kim, Crasco, Blank, & Smithson, 2001). This admirably large-scale effort to improve urban science teaching provides us with very few lessons. Whether these shortcomings are evidence of the impenetrability of urban school systems, their inherent resistance to reform, or the need for novel approaches remains open for discussion. What is clear is that changing science teaching in urban districts is not an easy task or one than can necessarily be solved through the infusion of substantial funds.

As described at the outset, the challenges associated with preparing teachers to work with diverse student populations are substantial (Wilson et al., 2001). The data from this study suggests that these teachers, as good as they seemed to be in practice, had inadequate knowledge about and appreciation of the backgrounds, capabilities, and lifestyles of their students. As suggested by Parsons (2003), by thinking about teaching as being cultural free or "ethnicblind," the teachers have defaulted their science teaching to a perspective of knowing embedded in the mainstream, dominant culture. Parsons calls for science teachers to "culturalize" science teaching wherein the implicit features of the curriculum and its delivery are acknowledged. Further, the culturalization of science teaching necessitates bringing the cultural backgrounds of the students into perspective, thus depicting science as a special culture so that those from other cultures can have access. Taking science beyond the simplistic notion of a body of knowledge has the potential for making the study of the subject attractive to and accessible for students who are not members of the dominant culture. Howes (2002) has made this a necessary aspect of preservice science teacher preparation.

There is a need to comment upon photographs as sources of data in science education research. One might question whether the teachers' interpretations of the photographs accurately reflect the intentions of the students. After all, one might ask, how can we be certain that the meaning made by the teachers (and by extension, the author of this research study) captures the reality of the students' worlds? The reply to this concern follows the same response to critique of all forms of qualitative research and perhaps to a substantial portion of quantitative research: All representations, including photographs, cannot legitimately claim to capture reality, but, instead, signify an individual's construction of their lived experiences (Winston, 1998). Within the discipline of visual sociology, the issues of authenticity and trustworthiness are used to separate the use of photographs from the merely artistic and into legitimate tools of inquiry (Prosser, 1998)

By investigating the possible influence of the students' photographs upon their teachers' perceptions of the students, this study uncovered a complexity not previously recognized. "Complexity" is not being used as a synonym for

"complicated" but, rather, in reference to the layers present in an urban classroom when it is viewed as a system. In this sense, complexity refers to the macroscopic dimensions of the classroom (e.g., interpersonal dynamics, curriculum implementation, instructional approaches) that cannot be determined solely by attending to the individual factors (e.g., district course of study, backgrounds of the students, availability of teaching materials)—instead, the classroom complexity is an emergent situation (Camazine et al., 2001). Philosopher Irving Berlin (1996) helps connect the complexity to the act of teaching:

> Action and the results of action in situations where only the surface is visible will be successful, partly, no doubt, as the result of luck, but partly owing to "insight" on the part of the actors, that is, the kind of understanding on which individual and social life is composed . . . in which all kinds of skills are involved—powers of observation, knowledge of facts, above all experience. . . . But there is an element of improvisation, of playing by ear, of being able to size up the situation, of knowing when to leap and when to remain still, for which no formulae, no nostrums, no general recipes, no skill in identifying specific situations as instances of general laws can be a substitute. (p. 33)

The teachers participating in this study operated within the complexity of urban education and based their moment-by-moment decisions about the observations and data available to them. Nevertheless, there are no general prescriptions that can be confidently applied. The need to make science more culturally responsive to urban schoolchildren remains. That the teachers did not have much in the way of concrete ideas about how to adjust their instructional practices only seems to reinforce this notion. Given that the teacher-participants in this study were relatively new to the profession, and because their concerns had more to do with management and scheduling, they were unable to consider, or at least to articulate, how they might adjust what they say and do so that science becomes a more significant subject for their urban students. This leaves open the door for continued inquiry about such issues.

Bibliography

Allen, N. (1998). *Not in our state: Authentic assessment for Native American students using digital photography*. Paper presented at the annual meeting of National Association for Research in Science Teaching, San Diego, CA. (ERIC Document Reproduction Service No. ED 418 851)

American Association for the Advancement of Science (AAAS). (1990). *Science for all Americans*. New York: Oxford University Press.

Au, K. H., & Kawakami, A. J. (1994). Cultural congruence in instruction. In E. R. Hollis, J. E. King, & W. C. Hayman (Eds.), *Teaching diverse populations: Formulating a knowledge base* (pp. 5-23). Albany: SUNY Press.

Berlin, I. (1996). *The sense of reality*. New York: Farrar, Straus and Giroux.

Camazine, S., Deneubourg, J., Franks, N. R., Sneyd, J., Theraulza, G., & Bonabeau, E. (2001). *Self-organization in biological systems*. Princeton, NJ: Princeton University Press.

Chance, L., Morris, V. G., & Rakes, S. (1996). Fostering sensitivity to diverse cultures through an early field experience collaborative. *Journal of Teacher Education*, *47*, 386-389.

Clotfelter, C. T. (1999). Public school segregation in metropolitan areas. *Land Economics*, *75*, 487-504.
Cochran-Smith, M. (1995a). Uncertain allies: Understanding the boundaries of race and teaching. *Harvard Educational Review*, *65*, 541-570.
Cochran-Smith, M. (1995b). Color blindness and basket weaving are not the answers: Confronting the dilemmas of race, culture, and language diversity in teacher education. *American Educational Research Journal*, *32*, 493-522.
Collier, J., & Collier, M. (1986). *Visual anthropology: Photography as a research method*. Albuquerque: University of New Mexico Press.
Delpit, L. D. (1988). The silenced dialogue: Power and pedagogy in educating other people's children. *Harvard Educational Review*, *58*, 280-298.
Emerson, R. W. (1979). *Nature, addresses, and lectures*. Cambridge, MA: Harvard University Press. (Original work published in 1849.)
Ewald, W. (2001). *I wanna take me a picture: Teaching photography and writing to children*. Boston: Beacon Press.
Farkas, G., Sheehan, D., Grobe, R. P., & Shuan, Y. (1990). Cultural resources and school success: Gender, ethnicity, and poverty groups within an urban school district. *American Sociological Review*, *55*, 127-142.
Gay, G. (2000). *Culturally responsive teaching: Theory, research and practice*. New York: Teachers College.
Haberman, M. (1992). Alternative certification: Can the problems of urban education be resolved by traditional teacher education. *Teacher Education and Practice*, *9*(1), 13-27.
Haberman, M. (1994). Preparing teachers for the real world of urban schools. *The Educational Forum*, *58*, 162-168.
Harper, D. (1998). On the authority of image: Visual methods at the crossroads. In N. K. Denzin & Y. S. Lincoln (Eds.), *Collecting and interpreting qualitative materials* (pp. 130-149). Thousand Oaks, CA: Sage.
Howard, G. R. (1999). *We can't teach what we don't know: White teachers, multiracial schools*. New York: Teachers College.
Howes, E. V. (2002). Learning to teach science for all in the elementary grades: What do preservice teachers bring? *Journal of Research in Science Teaching*, *39*, 845-869.
Huberman, M. (1993). Changing minds: The dissemination of research and its efforts on practice and theory. In C. Day, J. Calderhead, & P. Denicolo (Eds.), *Research on teacher thinking: Understanding professional development* (pp. 34-52). London: Falmer.
Kim, J. J., Crasco, L. M., Blank, R. K., & Smithson, J. (2001). *Survey results of urban school classroom practices in mathematics and science*. Norwood, MA: Systemic Research, Inc.
McIntyre, E., Rosebery, A., & González, N. (2001). *Classroom diversity: Connecting curriculum to students' lives*. Portsmouth, NH: Heinemann.
Meadows, L. (1997). *Undermining learning: Students and science teaching in an urban high school*. Paper presentation at the annual meeting of the National Association for Research in Science Teaching, Oak Brook, IL.
Meier, D. (1995). *The power of their ideas: Lessons for American from a small school in Harlem*. Boston: Beacon Press.
Metz, M. H. (1998). *Veiled inequalities: The hidden effects of community social class on high school teachers' perspectives and practices*. Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA. (ERIC Document Reproduction Service No. ED 420 629)

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis*. Thousand Oaks, CA: Sage.
Moscovici, H. (2003). Secondary science emergency permit teachers' perspectives on power relations in their environments and the effects of these powers on classroom practices. *Teacher Education Quarterly*, *30*(2), 41-54.
Naizer, G. L. (1997, March). *Science at home: Where do students find it?* Paper presented at the annual meeting of the National Association for Research in Science Teaching, Oak Brook, IL.
National Center for Education Statistics (NCES). (2001). *Teacher preparation and professional development* (NCES Document No. 2001-088). Washington, DC: U.S. Department of Education.
Newkirk, T. (1996). Seduction and betrayal in qualitative research. In P. Mortensen & G. E. Kirsch (Eds.), *Ethics and representation in qualitative studies of literacy* (pp. 3-16). Urbana, IL: National Council of Teachers of English.
Office of Educational Research and Improvement. (1996). *Urban schools: The challenge of location and poverty* (NCES Document No. 96-184). Washington, DC: U.S. Department of Education.
Orfield, G., & Eaton, S. E. (1996). *Dismantling desegregation: The quiet reversal of Brown v. Board of Education*. New York: New Press.
Parsons, E. C. (2003). Culturalizing instruction: Creating a more inclusive context for learning for African American students. *High School Journal*, *86*(4), 23-30.
Prosser, J. (1998). *Image-based research: A sourcebook for qualitative researchers*. London: Falmer Press.
Settlage, J. (2000). Appraising urban children's perceptions of science: Exploring the use of photographs as a researchable data. *Electronic Journal of Science Education.* Available online: <http://unr.edu/homepage/crowther/ejse/ejsev5n2.html>. Accessed September 24, 2004.
Settlage, J. (2002). Seasons change and conceptions shift—But not always as expected. In D. Tippins, T. Koballa, & B. Payne (Eds.), *Learning from cases: Unraveling the complexities of elementary science teaching* (pp. 103-109). Needham Heights, MA: Allyn & Bacon.
Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4-14.
Tatum, B. D. (1992). Talking about race, learning about racism: The application of racial identity development theory in the classroom. *Harvard Educational Review*, *62*, 1-24.
van Manen, M. (1977). Linking professional ways of knowledge with ways of being practical. *Curriculum Inquiry*, *6*(3), 205-228.
Villegas, A. M. (1994). *Culturally responsive pedagogy for the 1990s and beyond*. Princeton, NJ: Educational Testing Service.
Williams, L. (2000). *It's the little things: Everyday interactions that anger, annoy, and divide the races*. San Diego: Harcourt.
Wilson, S. M., Floden, R. E., & Ferrini-Mundy, J. (2001). *Teacher preparation research: Current knowledge, gaps, and recommendations*. Washington, DC: U.S. Department of Education.
Winston, B. (1998). The camera never lies: The partiality of photographic evidence. In J. Prosser (Ed.), *Image-based research: A sourcebook for qualitative researchers* (pp. 60-69). London: Falmer
Ziller, R. C. (1990). *Photographing the self: Methods for observing personal orientations*. Newbury Park, CA: Sage.

Correspondence regarding this article should be directed to

John Settlage
226 Gentry, Unit 2033
Neag School of Education
The University of Connecticut
Storrs, CT 06269
(800) 486-1151
john.settlage@uconn.edu

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