

Teaching Science with Homeless Children: Pedagogy, Representation, and Identity

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Abstract: In this article, I explore the question of what it means to create a science for all from the vantage point of urban homeless children. I draw on the work of critical and feminist scholars in science and education, as well as my own teaching and research with urban homeless children, to question how inclusive the science education community is in its efforts to understand the margins of science for all. I frame this analysis through the pedagogical questions of representation in science (what science is made to be) and identity in science (who we think we must be to engage in that science). *J Res Sci Teach* 35: 379–394, 1998.

One of the most popular and most powerful phrases connected to science education reform in the last decade has been “science for all.” Paul Hurd (1993) reminded us that this phrase was introduced into the science education community as early as an 1847 publication. Egalitarian in theory, this idea of science for all has proven difficult to actualize among all students, even with the renewed emphasis and central position of science for all in several national reform documents and projects in the United States [American Association for the Advancement of Science (AAAS), 1989, 1993; National Research Council (NRC), 1996]. Several reasons for the difficult transition between theory and practice have been documented: inadequate school and classroom resources (Oakes, 1990), insufficient knowledge base of teachers (Anderson, 1991), lack of interest and motivation of students (Kahle & Meece, 1994), and narrow visions of science implemented in schools (Roychoudhury, Tippins, & Nichols, 1995; Stanley & Brickhouse, 1995), to name only a few. In this article, I explore the question of what it means to create a science for all from the vantage point of urban homeless children. I draw on the work of critical and feminist scholars in science and education (Keller, 1985; Freire, 1971; Harding, 1986; Giroux, 1991), as well as my own teaching and research with urban homeless children, to question how inclusive the science education community is in its efforts to understand the margins of science for all. I frame this analysis through the pedagogical questions of representation and identity in doing science with urban homeless children.

From critical and feminist perspectives,¹ pedagogy involves the production of knowledge, culture, and identities (Giroux, 1991; Gore, 1993). It influences how teachers and students see and are seen by each other and how they interact with one another and with existing institutions

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and social practices. These interactions reflect the values, beliefs, bodies of knowledge, and styles of communication and biases of those who hold the most power in society (Gore, 1993). This means the production of knowledge, culture, and identity is a historically, socially, and politically situated process that is inherently subjective. In the case of science education, this means that pedagogy involves the production of scientific knowledge which in its broadest sense includes content, process, and discourse. It also means that pedagogy involves the production of values and beliefs about how scientific knowledge is created and validated, as well as who we must be to engage in that process. Because of the situated nature of pedagogy, knowledge construction about science and self-within-science occur within and are shaped by the relational space of the social, historical, and political. It is from this perspective that questions of representation in science (what science is made to be) and identity in science (who we think we must be to engage in that science) become central.

Pedagogical questions of representation and identity in teaching and learning science are linked to issues of power (i.e., who has the power to fashion images of science and identities in science?) and actuality (i.e., in what ways are these images and identities fashioned?). In terms of science in classrooms, the way teachers choose to represent science to students leaves room for particular kinds of engagements, particular kinds of activities, and particular kinds of identities. These questions of representation and identity are complicated because even when teachers assume control over what happens in science class (and therefore presumably the image of science which gets enacted by students), what ultimately transpires in science class is a joint act between teachers and students. This joint act is influenced by the kinds of connections teachers and students can make between their lives, experiences, values, beliefs, and science. It is also influenced by the ways in which each understands and values these connections. For example, to act in science class, students must have their own understandings of how it is they can act and of who it is they must be to successfully participate in a particular construction of science. Students can choose to model their image of science after what is presented to them by their teachers and then act or not act accordingly; or they can choose to create an oppositional image of science and then act or not act accordingly. They can also choose something between these two extremes. In the case of homeless children, such questions of representation and identity are critical because their experiences are typically not mirrored in the science of schools.

Educating Homeless Children

There is growing evidence that schools in the United States and abroad serve to reproduce status quo values and expectations (Giroux, 1991). This is due to stark inequalities in educational funding and an ideological basis which serves to legitimize white and middle-class experiences while marginalizing "others'" experiences (Kozol, 1991). These hegemonic practices have resulted in an unarticulated, yet highly active caste system (Quint, 1994). To move up in the system, individuals are often expected to redress personal and culturally specific ways of knowing and being in the clothes of a neoconservative mainstream culture, or risk being labeled "other" (hooks, 1994). Through the politics of assimilation and the pervasive yet historical racial and class subjugation in schools, educational institutions foster the very social inequalities they were designed to prevent (Quint, 1994).

The most invisible others in schools have been homeless children whose marginality has been exacerbated by a blaming the victim mentality, and by a system which promotes and maintains a class-stratified society (Diver-Stamnes, 1995). Homeless children make up 25% of the homeless population in the United States, and a large percentage of these children emerge from

the inner city and from single-parent (female)-headed families, thereby inextricably linking the problem of homelessness with race and gender (Quint, 1994). Women and girls are particularly vulnerable to violence in the streets, and along with all people of color, often face overt discrimination in the housing market (Kozol, 1988).

The transient lifestyle led by homeless children and their families engenders feelings of not belonging. For example, in schools, homeless children are openly referred to as “shelter rats” by their classmates and teachers (Quint, 1994). This is often due to the fact that homeless families lack the resources needed to provide their children with educational daycare, private education and tutoring, and private instruction in sports and the fine arts. These kinds of inequalities lead homeless children to feel that their own life experiences are somehow inferior to those of normal children. As a result, homeless children disproportionately battle depression, rage, and mental anguish (Quint, 1994). As McChesney (1993) wrote, “All of these children are stressed. They have lost their own clothes and possessions, have been doubled up, have moved from place to place, and have no privacy or space of their own. Their parents are often the only sameness they have left” (p. 377).

The physical and psychological manifestations of homelessness take many forms. Homeless families move frequently because of length restrictions in shelters, short stays with friends or relatives, and employment relocations. These circumstances make regular school attendance difficult. Students are often forced to change schools several times midyear or to take absences from school to attend to family needs such as child care and work or because of guardianship requirements, transportation, immunization records, or the lack of a permanent address. Furthermore, girls in homeless families are often given total child care responsibilities for younger siblings while the mother goes to social services or to work (or in search of work). Consequently, nearly 50% of homeless children in the United States do not attend school regularly (Stronge, 1992), with 10% not attending school at all (Stanford University Center for the Study of Families, Children, and Youth, 1991). This is a significant figure when viewed in light of the fact that there were 1.5 million homeless children in the United States on any given night in 1991 (Polakow, 1993).

Educational success, already made difficult by such discriminatory practices of society, becomes further elusive for the urban homeless because of programs such as early tracking, grade retention, remedial programs, scapegoating, and transition room placements, nearly all of which, in their current forms have failed to provide children with the quality instruction needed for academic success (Polakow, 1993). The result of these practices are educational underachievement. Homeless children are less likely to score at or above grade level in reading and math, and are more likely to have repeated grades (Rafferty & Shinn, 1991). Schooling, often the only road out of poverty and homelessness, has also contributed to the cycle of poverty, especially in the inner city. In short, the urban homeless are most at risk for receiving an inequitable education.

Linking Homeless Children to Science for All

The needs and questions of homeless children have thus far not been identified as a significant thread to the fabric of science for all. Even issues of children living in poverty² have been marginal to this debate. Yet, science for all has been a central theme of recent reform initiatives. Since the reemergence of science for all as a national goal in the United States, research studies and theoretical debates have been conducted to make sense of the ways in which efforts toward scientific literacy for all have been inclusive and supportive of the needs of those groups of children historically marginalized by school science (Atwater, 1996; Barton & Osborne, 1995; Brickhouse, 1994; Kahle & Meece, 1994; Roychoudhury et al., 1995).

Questions of science for all have been linked, in part, to equity debates in science education. Brickhouse (1994) pointed out how these equity debates can be categorized into two models: the deficit model and the inferior treatment model. The deficit model focuses on the ways in which girls and minorities underperform in the sciences and the kinds of remediation programs required to bring them up to their more successful counterparts. The inferior treatment model focuses on the structural and institutional constraints that pose barriers to successful participation in science by girls and minorities (lack of teacher support, encouragement, attention, after school activities, role models, and peer support). As Brickhouse pointed out, the inferior treatment model has been important because it challenges the assumption that the current status of girls and minorities in science is natural. Studies within this camp have moved the agenda of science for all forward by integrating the needs of diverse students into teaching and learning agendas (Equity Coalition, 1990). Many feminist studies have also emerged from this camp in search of a more equitable science education. These studies have highlighted a need to explore multiple ways of knowing and doing science which are reflective of the social, historical, and political context in which science has been constructed and in which children learn that science (Roychoudhury et al., 1995). In what follows, I focus on such feminist studies to explore what it means to create a science for all from the vantage point of urban homeless children.

Feminist and critical researchers in science education have used the movement to understand science as a social construct as a way of sparking debate about ways of knowing science and the implications this has for science for all (Atwater, 1996; Eisenhart, Finkel, & Marion, 1996). Social constructivism represents a significant shift in thinking in science education because it unpacks the positivist myth that there is an objective, solitary way of doing science which results in independent, unbiased knowledge. Social constructivists argue that the positivistic myth is falsified because science is a human endeavor and therefore subject to human biases, social conditions, and ambitions (Longino, 1990). Feminist social constructivists further argue that these biases infiltrate every part of science, including its norms, beliefs, values, discursive practices, and ways of acting and reasoning. This shift has propelled equity efforts to search for the ways in which the traditional discursive practices and epistemological and ontological assumptions of western science can be marginalizing to large groups of students (Atwater, 1996; Roychoudhury et al., 1995).

Urban homeless children, like all children, learn science in and through a variety of contexts: in school, out of school, and from families, friends, and the media. As they learn science, they also learn a lot about who they are (and can be) and what science is (and can be). Children learn about the production of knowledge, values, social identities, and power, and their interconnections. In other words, pedagogy in science classrooms is also about the struggle for identities and representations. This presents a daunting picture for science teachers and researchers because it suggests that we need to think about much more than scientific concepts when we think about helping all children to become scientifically literate. This picture suggests that we need to think about how children *perceive themselves* within and outside of science, and the choices they make because of those perceptions. We also need to think about how children *perceive science* and the kinds of interactions they believe they can have—or that they want to have—with that science. Finally, we also need to think about how these perceptions of and choices about self and science are influenced by the various and complex power arrangements active within the science and educational communities, within families, and within society in general. In the remainder of the article, I address these issues. I do so through two main themes that integrate the pedagogical questions of representation and identity in science: examining and

recreating science through lived experience,³ and examining and recreating lived experience through science.

Research Study and Methods

This article is constructed from data gathered during 1995 and 1996, and is part of a larger 3-year study to understand the issues and concerns that homeless children and children in poverty bring to learning and doing science. The research is based on interactive ethnography (Maher & Tetreault, 1994) and teacher research (Cochran-Smith & Lytle, 1993). These methodologies fall into the categories of action research and interpretive design. The research seeks to politicize and deconstruct knowledge, power, and relationships between students, teachers, researchers, and science (Gitlin, 1994). It also demands self-reflexivity on the participant-researcher's part. The reflexive interactive design (Erickson, 1986) reflects the circular process of integrating experience, interpretation, and understandings and its associated ongoing data framing, analysis, and interpretation.

The data sources for the research include the field notes of the researcher, a personal teaching journal, video and audiotapes of the science program at the shelter, videotapes produced by the children, interviews with the children and their parent or legal guardian, and written work produced by the children. Three target students were studied in depth during the 1995–1996 school year to learn more about how they negotiate relationships with others and with structural and cultural institutions outside the science sessions. Target children were interviewed three times. Finally, interviews with target children's school teachers, parents, and other adult supervisors were also conducted. Video- and audio-tapes of interviews and the after school program were transcribed. The reason for these multiple data sources is triangulation of data. Interview transcriptions, science session transcriptions, and field notes were coded around several themes including the feminist themes of identity and representation used in this article. During the course of the research presented, member checks (Guba & Lincoln, 1989) were systematically used to check intentionality and to revise interpretations and analysis.

I have chosen to share my research findings through narrative because it reflects the stance that all research is a social construction practiced and produced by people working, acting, and thinking in relationship with other people (Packwood & Sikes, 1996). Presenting this research as narrative also allows me to convey the context of my study (Tobin & McRobbie, 1996), express its temporal dimensions (Stanley & Wise, 1993), and acknowledge my influence on the study as narrator (Packwood & Sikes, 1996). This last point is most significant in my research presentation because I am both a teacher and a researcher.

Setting and Participants

I have been teaching science to urban homeless youth in an after-school science program (referred to here as "science time"⁴) from a feminist social constructivist philosophy in which the participants explore science together and, through conversation, come to construct meaning (Barton, in press). Science, in this framework is a process which can be constructed out of any pursuit, experience, or interest that the participants bring. One of my goals as the teacher is to validate the children's experiences by using their experiences as the starting point for our explorations. The youth in the science program always take the lead in planning future activities, including developing a list of the questions to be explored as well as a list of the materials that

I need to bring. They also take the lead in documenting their explorations, including what and how they choose to write about the science sessions in their journals to the quantity and types of pictures and videos that they take with the cameras supplied for their use. Science becomes their process of questioning their world. Therefore, critical to my actions in science time is to help the youngsters to locate questions in their experiences and to work together to find ways to critically explore those questions.

For 2 years I visited the Carla Voster⁵ homeless shelter, located in an urban center in the northeast part of the United States, twice a week. The shelter is located in a depressed urban center. It is surrounded by condemned dwellings, several closed eateries, and two Baptist churches, both of which are located in former business buildings. There are also three functioning small convenience stores, an old gas station, a recently deserted used car dealership, and an abandoned half torn-down lot fenced off with police tape.

The shelter is three-story structure originally built in the early 1900's. Inside the shelter, there are enough rooms to house 10 families. Each family has its own room (large enough for four people with the use of bunk beds) and a bathroom which is shared with all the inhabitants on the particular floor. There are four community areas: the dining room, the attic (a small room with toys and a television), the lobby/TV room, and the meeting room in the basement. Our science sessions are held in the basement by request of the shelter administrator, although much of what we do occurs outdoors.

In the middle of the 1995–1996 winter, there were 22 children of school age living at the shelter. With the exception of a family of four who lived with a single father, all of the children lived with single mothers. Three of these children were target children in this study: Gilma, Patrice, and K'neesa. They are introduced briefly below.

Gilma

Gilma is a 13-year-old sixth grader. She lives at the shelter with her sister, two brothers, and mother. They moved to the shelter from the West coast, where they had lived for a year after emigrating from Mexico. As the oldest child, a female child, and the only family member fluent in English, Gilma had primary child care responsibilities for Isabel (7 years old), Thomas (3 years old), and Carlos (18 months old). Over a 12-month time span where I visited the shelter weekly, Gilma had child care responsibilities all but two times. Gilma's mother could often be found in the kitchen preparing dinner (all adults who live in the shelter must actively participate in its maintenance), negotiating her way through the social services circuit trying to secure housing and medical care for herself and her children, seeking out employment, or just taking a break. Gilma also served as the primary translator between her family members and other non- and limited-Spanish-speaking people (such as myself, many other shelter dwellers, and the shelter administrators). She often made fun of her own thick Mexican accent by drawing out her accent on certain words—calling attention to herself, her difference.

The first day I met Gilma was also the first day I visited the shelter. She and her family had been living there for 6 months, and as Sharon, the shelter administrator informed me, was “not leaving anytime soon.” I met Gilma first as a name in blue ink sandwiched between her mother's and sister's name, on a white dry-erase board in Sharon's office. The number “13” and the letter *f* were scribbled after her name to indicate her age and sex. My first physical encounter, occurring less than an hour later with Gilma, in many ways was not very different: I talked; she was painfully quiet.

After a month of weekly visits to the shelter, my relationship with Gilma changed. As I walked toward the front door one Tuesday afternoon, I heard my voice being sung from above

with a careful but gentle accent. Gilma and her sister were hanging their heads out the third-story window, smiling and waving me in. I was immediately reminded of the literature surrounding homelessness and its effect on children. It has been argued that one of the most psychologically devastating aspects of being homeless as a child is the uncertainty and instability of not knowing where the next meal will come from, of when she will change schools, of where she will sleep (Quint, 1994). In an initial interview with a leader and activist within the local social services community, I was told that this research project was not only a commitment to research, but also to the children, and that “unless I was on my death bed,” I had better not miss a scheduled visit. I recognized that I had begun to earn Gilma’s trust simply by returning each week to spend time with her and the other children.

For most of the year that Gilma and her family lived at the shelter, Gilma was one of the oldest children. She was 13 and developing physically and socially. Her developing social and sexual identities overpowered most of her interactions with me and with the other children at the shelter. They certainly affected her decisions about when and why to do science. In fact, she often did science to create more space for her developing social and sexual identities. For example, when the children developed a project to study the pollution patterns, causes, and effects in their local community (which included video documenting the community, interviewing local business workers and neighbors, collecting trash, and planting flowers and vegetables), Gilma took the lead, getting the rest of the children to develop reasons for getting out of the shelter and into the community. She used the space of finding scientific things for us to do to leave the shelter property (a place that she perceived as a social stigma), and to visit La Comida Deli to buy penny candy and talk to Antonio, whose parents owned the deli. It was obvious that these were her main reasons for wanting to go out into her community to figure out how to make it better for herself, her friends, and her family.

K’neesha and Patrice

K’neesha and Patrice are African-American sisters who live at the shelter with their mother. These two girls had just moved to the Northeast from the South because their mother wanted them to live closer to their father (who was now in substance rehabilitation locally) and because their mother “hated the South,” where they had spent 6 months living in two different homeless shelters. The move to the South, K’neesha and Patrice told me, all happened right after things seemed as if they were going well—their mother and father had just moved into permanent housing in the city, which had been made possible through both parents securing full-time minimum wage jobs. However, things took a turn for the worse when K’neesha’s and Patrice’s father slipped back into substance abuse. He lost his job, and without two incomes the family lost its home. They moved South with their mother to get away from the abuse and to start over.

The first day that I met the two girls, I engaged them in a conversation about school and learned that school had been a problem since their recent move back to the Northeast. K’neesha informed me that since having been introduced to the principal the previous week, they had been sent back to the shelter and had not yet returned to school. I also learned that K’neesha was being held back in the seventh grade because, in her words, she was “stupid,” and she did not want to take the test they told her she needed to pass to get into eighth grade. K’neesha was turning 14 years old the following week. K’neesha also said that it was depressing to be held back because everyone knows “you’re stupid, you’re older than everyone else,” and you feel like “you try and try and it don’t get you nowhere, like you was never goin’ to make it no matter what.” She then told me that her sister Patrice was smart and that she was not being held back.

The school conversation with the two girls also shed some light on Patrice. Patrice was a “smart” sixth grader who was afraid of losing that status because she “keeps changin’ schools ’cause [she] keeps changin’ shelters.” She explained that every time she missed a couple of weeks of school, she fell further behind. Patrice reiterated K’neesha’s exasperation when she said, “I know I am smart, but I’m afraid I never gettin’ out of sixth grade. Every time we change shelters, I change schools, then I miss school for a time. When I go back, I’m way behind. I don’t want to be in sixth grade forever. I want to move on. Move on, or all this shit be for nothin’.”

K’neesha, who had been labeled in school as “learning disabled,” often shared during science time that she believed she was stupid and incapable of meeting the academic demands of school. She certainly had her reasons for feeling this way. One month into her life at the shelter, she learned she was to change schools. As K’neesha informed me, “I’m not changing grades, they’re sending me to a different school for slow kids.” It was later learned through more formal channels that K’neesha’s new school was one of the “alternative schools” which is part of the state public school system designed to educate children who are judged not capable of coping with the traditional academic-based program. K’neesha’s particular school is widely perceived as a last stop for many slow-learning and behavior problem children.

K’neesha’s school had strategies for educating slower children: Send them to the alternative schools. However, K’neesha made choices for herself and her younger sister which reflect priorities different from what was expected in schools. For example, K’neesha chose on many occasions to turn in incomplete homework assignments so that she could care for her younger sibling at the shelter as well as her own mother (who was heavily medicated and prescribed bed rest). It is also important to look closely at why K’neesha is a 14-year-old seventh grader. When arriving at her new school this past winter, she elected not to take the tests she needed to pass to be accepted into the eighth grade. She explained that it was because she was stupid and would not pass it anyway.

K’neesha, who has attended three different schools, all while in the seventh grade, has taken personal responsibility for her feelings of inadequacy. Her apparent disappointment in herself make it no surprise that the dropout rate doubles for students who are held back (Fine, 1991). The experiences of K’neesha and Patrice support the research on schooling in urban poverty: “Being left back may offer the final justification to give in, to acknowledge defeat, and to surrender to the pressure of poverty and family need” (Fine, 1991, p. 74).

Discussion

Examining and Re-creating Science through Lived Experience

How are students’ lived experiences used, manipulated, forced, pulled, and tugged to fit within the confines of science? In the enthusiasm—the passion—to help children develop understandings of scientific principles, concepts, and processes, there sometimes exists a forgetfulness toward the idea that children, like all human beings, come to understand the world through multiple and intersecting lenses. As a result, children’s readings of their experiences often do not fit neatly or fully those prescribed experiences located within the borders of science. This question is significant when placed in the context of representation and identity in science. If the borders of science are expanded or made fuzzy, then there will be more room to fit children’s experiences that cannot be neatly labeled as science. Valuing these experiences shifts the dynamics of what counts as science and who can do science because children would not have to silence certain experiences or feelings traditionally labeled outside of science.

Let us return to K'neesha, Patrice, and Gilma to make sense of this idea of creating science out of experiences which are not neatly categorized as science. This was brought out clearly in the three girls' experiences studying the pollution in their neighborhood. One common theme across several months of science time related to the mixed feelings the children had about living at the homeless shelter. On one level, they were thankful that they had a safe place to live, but they also described confrontational situations at school where they had been labeled "shelter kids." Gilma, in particular, struggled with this issue. She said that she would rather "lose a friend before I tell them where I live." Given Gilma's extremely social personality, this was a dire threat. On another level, the children were delighted that the shelter had a backyard in which they could play supervised; yet, they also told stories of how they disliked the "ugly" and "dirty, rundown, and polluted" neighborhood. For example, K'neesha and Patrice told stories about how they did not like walking past the abandoned lots on the way home from school, and they especially did not like the old gas station across the street because it always "smelled like gas." The two girls even told me of a secret path they would walk along the railroad tracks that they could take to the backyard of the shelter because it allowed them to bypass the one house with bottles and vials strewn carelessly across the front yard and sidewalk.

The children's social and natural curiosities about their neighborhood provided an area of long-term study: pollution and the local community. It was a topic that was of interest to the children; it permeated their talk and actions every time I visited the shelter. I helped the children start the project by formalizing their complaints of where they live by recording them in a column on a huge piece of newsprint. Next to their complaints were two additional columns which read, "How this makes me feel" and "Other effects." Over the weeks that followed, the children devised a plan for learning more about the chart they constructed. First, they gathered more data for the chart by walking around the neighborhood to interview anyone who was willing to be interviewed about their thoughts, feelings, and ideas about pollution. For example, they asked, "How do you feel about where you live/work? What kind of pollution bothers you most? Do you think the gas station creates pollution? Do you create pollution?" They also gathered evidence through library research. As a result of what they learned, they created and enacted plans for picking up neighborhood trash, for planting vegetables and flowers, and for recycling. In this case, the science grew out of the children's experiences.

The driving forces behind the children's desire to develop an 8-week project on pollution were their negative reactions to where they lived and why they lived there. In traditional science practice, emotion and reason, mind and body are separated. So are the researcher and the researched. The children forcefully enacted a science that merged these qualities. As the teacher in this setting, I also believe that these qualities simply could not be separated because combined, they are what constituted the children's experiences. The children wanted to study their local community because they have a relationship with it posited on negative feelings and experiences. Their science not only involved data collection and analysis, but also involved their feelings and values. For K'neesha and Patrice, the project literally meant finding answers for why the neighborhood was so ugly and dangerous, and finding ways to change it. For Gilma, whose negative reactions to the shelter were more focused on her having to spend time there, this pollution project meant finding safe spaces away from the shelter property.

Another example of creating science out of experiences that cannot be neatly categorized as science involves food experiments. Quite often during the 1995–1996 school year and summer, the children's self-designated explorations focused on food: making experimental pizza, pancakes, jelly, and fried rice, and gardening vegetables of their choice for future recipes. I have been happy to oblige with these desires, for several reasons. First, the refrigerator in the shelter kitchen is off-limits to shelter guests. Second, the children are not allowed to have food in their

rooms at any time, for any reason. They are allowed to eat at the shelter in the dining room and only when they are given food. Patrice and Gilma have told me on several occasions how hungry they get at night. It seemed important that this dimension of their lives serve as a focal point for science time.

There are many examples of when experimental food took over our agenda. One afternoon late in January, when the children talked about what they wanted to do together the following week, it came up that two of the children's birthdays would take place the following week. Once the birthday issue was made public, the children quickly decided that they wanted to invent birthday cake recipes. The children talked about what was needed for that activity and why. This involved doing two things: First, they closed their eyes and pretended they were eating a piece of cake, to use their memories and imaginations to hypothesize what ingredients would be required. Second, they recalled similar cooking experiments they had done in the past, and the results—what happened and why.

Yet, it did not take special events to get the children to want to experiment with food. For example, one afternoon, K'neesha came up with idea that she wanted to make edible play dough: "Oooh, I know. I know. I'm going to make me some dough to play with and eat!" There was a lot of flour, water, food coloring, and other items in the science corner left over from the previous week's experiments with pancakes. K'neesha grabbed a clean bowl and started mixing flour and water. While working, K'neesha turned her body front and center to the video camera she had placed near the table earlier, and narrated her process for her "viewing audience":

Right now, I am mixing flour and water so I can make a thick lather. Right now, I haven't got it, so I have to put more water in, and so I mix it with my hands till I get a thick lather. You can also eat the flour. I am sure that is what most people do out there while they are cooking. They eat the dough while it is rising. Well, this is what I want to do, so I keep mixing and keep mixing. Then I keep mixing. And so you can see it is sticking to my hands already. It is startin to get a little, you know, thick.

Patrice, who in the meantime had started her own dough, moved her bowl closer to K'neesha's and began to speak to the camera, over K'neesha's voice:

Patrice: As my hands are sticky, I take this [measuring cup] and get a little of this [flour]. Just shake a little off and you mix it up . . .
 K'neesha: [Interrupting] You can add peanuts too . . .
 Patrice: . . . And you mix it
 K'neesha: [Interrupting] . . . And pretzels
 Patrice: . . . And you mix it.
 K'neesha: Oh gross! Don't it look groooooosss! Yuumm!

In these two descriptions of science time, it is clear that the physical and social circumstances of the girls' lives shaped their interaction with science. Although it was through the process of developing an experimental recipe that the girls had the chance to use and hone their scientific skills in observation (What does the cake taste like? Feel like?), relationships (i.e., How much sugar to flour?), and analysis (What worked last time, and why? What did not work last time, and why?), it is important to note that the girls practiced these skills and discussed new knowledge in a way that connected to the daily routine and struggles in their lives. They were hungry, and they wanted a safe space to eat and a safe space to play around with what they ate. This last point is significant. As I wrote earlier, food is a source of stress for homeless chil-

dren because it is not always easily come by, and its form is rarely of their choosing. Our experimental recipes violated this policy (with permission) in a safe way for the children.

These stories about pollution and food illustrate how the science done at the shelter grew out of the children's lived experiences. They illustrate that because the children's experiences involved many things besides science, the science the children learned was not confined to traditional scientific concepts and principles, or even processes. In fact, I would argue that a significant piece of using lived experiences to create science is the decentering of science. Science, during science time, was represented as something that was integrated in messy ways with other things. Doing science was part of, but not more important than, everything else that went along with the things the children at the shelter did during science time, such as stress about food, hunger, play, and relationships. One way to think about decentering science is to think about the fuzzy borders encountered and also created by the children at the shelter which separate science from other things. With this argument, it is easier to see how the role of science time was not simply to help the children do science, but rather to do that which grows out of their questions and experiences. It was not to fit their experiences into science; it was to fit exploration of the natural world, questioning, and critique into their experiences. This distinction is important because it makes the borders of science fuzzy in two ways. First, it removes the binary distinction from doing science or not doing science and being in science or being out of science. Second, it allows connections between students' life worlds and science to be made more easily. This is significant because, as the feminist arguments remind us, much of the culture, discourse, and content of science is reflective of masculine, Western, and middle-class values (Harding, 1986). Using lived experiences to create and decenter science provides space for multiple voices to be heard and explored. When multiple voices are heard and explored, children learn that their experiences do not have to be channeled into defending a particular reality, and that there is room for them to play with their representations of science and their identities within science.

Examining and Re-creating Lived Experience through Science

So far, I have argued that the pedagogical questions of representation and identity are central to weaving the concerns and needs of homeless children into a teaching practice of science for all through creating and decentering science through lived experience. In this section, I put a reflexive twist on this idea to examine the importance of helping children to examine their lived experiences through science. This reflexive twist is necessary because when children use their experiences to construct new ideas about science, their ideas about what science is and how they connect to it change. I suggested in this last section that the knowledge the children at the shelter constructed about science was linked not only to science but also to other areas of their lives—that the borders of science were fuzzy. Consequently, any new knowledge the children have about science feeds back into their lives in multiple ways and provides them with altered lenses to understand their experiences.

Let us return to the pollution project to make sense of how the children used science to examine their lived experiences. In the pollution story, the children explored the causes and effects of pollution in their community, and they also questioned why it was their own neighborhood had to be ugly and not the one on the other side of the railroad bridge. Furthermore, they used their research—which drew heavily from their personal observations—to challenge what the other people were telling them to believe. That is, the children transformed their experience into evidence to challenge some of the comments made by the pollution offenders. For example, when the children were interviewing an attendant at the gas station about the kinds of pol-

lution the station produces, the gas station attendant told the children because he followed guidelines for gas stations; he did not create any pollution. But K'neesha insisted that because she "smelt gas" and "saw [oil] stains on the cement" his answer could not be entirely true. K'neesha's persistence with the children's data raised questions for the rest of the group about the tension between their experiences, their data, and their role in sorting through the relationship between the two. The children also learned through their project that they did not have to accept the way their community looked, that there were things they could do to change it into something they felt good about, such as picking up trash, recycling, and planting flowers. Science in this sense was not merely functional but a productive force that helped the children to challenge the existing social conditions in which they lived. The children developed a science that helped them define and articulate their own agency.

This same lens can be brought to reexamine the food experiments. As I described earlier, experimental food as a focal point for science time illuminates just how the social and physical circumstances shape the ways in which children engage in science: The children are hungry, the food is physical and emotional nourishment. Yet, there is another level which permeates work with experimental recipes. Focusing conversation, exploration, and questioning around food merges into other areas of the children's lives. Food is a source of stress and a reminder of their social and physical status as homeless children (McChesney, 1993). After school, snacks and meals obtained outside school or the shelter are not easily obtained. Our explorations with food also simultaneously made visible a critique of the myth of childhood. These children do not need to be told that the prevailing historical and cultural images of childhood—two-parent families living in permanent housing and eating cookies after school in white middle-class America—are skewed. Their lives are witness to another reality. However, centering explorations on food extended far beyond key concepts and principles, because it also constituted a discourse of revelation that exposed the invisible and allowed the children to name and critique their reality for what it could have been and what it can become.

For example, the children used the time spent on experimental recipes to talk about the unfairness of the food policy at the shelter and about their dislike for the food that they were given to eat at the shelter. This is significant because complaining about food is a taboo subject among homeless children. This was also evident in some of the writing that the children did in connection with the weekly food experiments. During several of the science time sessions together, the children wrote about their immediate feelings in their journals. Unlike traditional forms of writing in school, in science, and even in writing workshops, the purpose of having the children write during science time was entangled with the political agenda of liberatory education (Lensmire, 1994). The children were rarely asked to write their journals in any specific kind of format or on any specific topic. Gilma's 7-year-old sister Isabel, who was constantly hungry at science time and who vocally spoke out against the shelter's policy on "no food except at meal times," revealed her world of hope (to have food) and despair (to have her food time taken away) in a poem on inventing food:

Im in the mood
To invent food
so dont bug me dood.
(Isabel's journal, 1996)

As Isabel's writing illustrates, science time was most importantly about understanding, critiquing, and actively reshaping experiences in a world composed of asymmetrical power arrangements—power arrangements which have molded these girls' lives through Gilma's

forced child care responsibilities, K'neesha's and Patrice's abuse by their father, and all of the children's neglect in a system which conceals the experiences of the urban poor.

The reflexive relationship between lived experiences and science highlights just how central the pedagogical questions of representation and identity in science are to what happened in the after-school program at the homeless shelter. In the case of the video documentary and cleanup project, the students constructed their own knowledge about their local community and its problem of being ugly and about what is important for these children to know and do to transform the ugliness into something else. Their open subjectivities shaped their questions, their research design, and their interpretations. It also shaped the way they brought that science back to understanding their own lives. The doing of science involved merging the emotional with the physical and intellectual. The students found their experiences with the ugliness of their community or with hunger as important and more complex than science could describe in its neutral language. The children openly struggled against the powerful claims of the dominant scientific culture of true descriptions of the world. Through sharing their personal theories of the local community's pollution or of the shelter's policies about food, the children used their own lived experiences to define science, in both practice and content. They then used that science to reexamine their experience. This suggests that teachers play a crucial role in how pedagogical issues of representation and identity emerge in science class because of the role they play in helping children develop a reflexive relationship between science and school and the rest of their lives.

Conclusions

The stories of K'neesha, Patrice, and Gilma illustrate how significantly different life experiences intimately shape the ways in which children engage each other and the ways they think about science. Children are not the generic blank slates that many curriculum orientations assume. Urban homeless children carry to school with them a set of struggles not reflected in the typical science curriculum. This research proposes that we find a place for their lives in science and for science in their lives. This approach shifts from the traditional paradigm, where science lies at the center, as a target to be reached by students at the margins, to inclusion, where students' identities remain a central focus that guides pedagogical democratic principles and which transform them so they become an integral part of their lives.

Making the pedagogical questions of identity and representation central to the struggle to create a science for all pushes against the historically accepted modernist frameworks of positivism, instrumental reason, universal knowledge, and bureaucratic control that have been at the center of curriculum and practice in science education. From the feminist perspective brought to bear on the experiences of homeless children in this article, I have tried to argue that science education can no longer hide behind the modernist claim to objectivity and universal knowledge. Rather, teaching and learning science, like teaching and learning anything, must be defined as a cultural practice that is accountable ethically and politically for the stories it produces and for the images of the past, present, and future it deems legitimate (Lewis, 1993). It must be located within a discourse of human agency that is focused on self- and collective empowerment. This is very different from the modernist belief in objective truth, where only one voice, one set of experiences, is given legitimacy.

If *all* students are to participate in science in genuine ways, then teachers need to find ways to value the diverse ways of knowing brought to class by the students. In the case of the after-school science program at the homeless shelter, I needed to value a science which emerged from the intersections between the children's ways of knowing their world and ways of knowing and

doing science. Because the children's experiences occurred within and were reconstructed through social frameworks, their experiences shaped the science gatherings from food to pollution. This kind of valuing of lived experience in science class complicates individual and collective representations of science and identities in science. Valerie Polakow (1993) wrote, "Teaching the children of poverty confronts teachers with a world they would rather not confront, for such children reveal the inequalities and injustices that shape their young lives in the other America" (p. 107). However, unless this struggle is engaged openly and with a vision of possibility in schools and in colleges of education, the very institutions meant to bring out equity will continue to condemn urban homeless children to a life of marginality. Educators must begin to view their own classrooms through the eyes of a child who is hungry, who is sick, and who cries deeply inside for love, support, and stability. As John Dewey often reminded us, the child's entire life world must be taken into account.

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Notes

¹ I use these two perspectives because I use gender, race, and class as central and interconnecting analytic constructs. In the remainder of the article, I will refer to this position as a critical feminist position (see Weiler, 1988).

² Children living in poverty is defined by children living in conditions where the income for a family of four is \leq \$15,771. In 1995, 20% of children in the United States were living in poverty (Kilborn, 1996).

³ I use the phrase "lived experiences" in the way that van Manan (1990) used it. He argued phenomenologically that we read, interpret, and analyze our experiences through particular lenses. These lenses are shaped and curved by our social, cultural, and historical locations. The subjective reading of experience and the placing of value and meaning on the experience constitute lived experience. Therefore, the phrase "lived experience" differs from the more general phrase "experience" in that it implies an articulated web of interactions and subjective meanings crafted through cultural, historical, and social juxtapositions.

⁴ "Science time" was the phrase used by the shelter administrator and adopted by science time participants. It was (and is) a name I have resisted because I feel that it makes science more important and more central than the children.

⁵ All proper names (institutions, towns, and people) are pseudonyms used to ensure the anonymity of research participants.

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