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Learning to Teach Science in Urban Schools

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Abstract: Teaching in urban schools, with their problems of violence, lack of resources, and inadequate funding, is difficult. It is even more difficult to learn to teach in urban schools. Yet learning in those locations where one will subsequently be working has been shown to be the best preparation for teaching. In this article we propose *coteaching* as a viable model for teacher preparation and the professional development of urban science teachers. Coteaching—working at the elbow of someone else—allows new teachers to experience appropriate and timely action by providing them with shared experiences that become the topic of their professional conversations with other coteachers (including peers, the cooperating teacher, university supervisors, and high school students). This article also includes an ethnography describing the experiences of a new teacher who had been assigned to an urban high school as field experience, during which she enacted a curriculum that was culturally relevant to her African American students, acknowledged their minority status with respect to science, and enabled them to pursue the school district standards. Even though coteaching enables learning to teach and curricula reform, we raise doubts about whether our approaches to teacher education and enacting science curricula are hegemonic and oppressive to the students we seek to emancipate through education. © 2001 John Wiley & Sons, Inc. J Res Sci Teach 38: 941–964, 2001

Without doubt, teaching and learning science pose many challenges even in the best of circumstances. These challenges increase in number and intensity in those urban schools that must deal with inadequate funding, teacher shortage, lack of resources, and a high proportion of students from conditions of poverty (Tobin, Seiler, & Walls, 1999). Regrettably, the problems often reflect deep issues concerning race and social and cultural factors that are at the core of life in the United States (Pinar & Bowers, 1992). At present, gains in the quality of urban science education have been modest at best, despite the concerted efforts of funding agencies, policy

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makers, teacher-educators, teachers, and educational researchers. Without diminishing the efforts of agencies or hardworking professionals, our ongoing ethnographic research in urban high schools suggests that we are still in the midst of a crisis (Tobin, 2000). As large cities in the United States and elsewhere struggle to provide high-quality education, they are too often faced with shrinking budgets and shortages of well-qualified teachers, especially in science. According to the 1990 U.S. census, about 75% of the U.S. population lives in urban areas. However, education is a critical issue in the largest U.S. cities, where the number of children living in poverty is significant. For example,

> even though poverty appears to be decreasing in the United States, about 12 percent of the population, more than 52 million Americans, experience economic hardship. The recent Report on Poverty in the United States (Dalaker & Proctor, 1999) showed that 16% of the residents from inside central cities live in poverty, almost 22 percent of those in poverty are African American and 17 percent are less than 18 years of age. At the intersection of these data are inner city, Black students, the focal participants in this research.

It is not easy to remedy this situation because society, at best, requires its schools to re/produce itself. That the level of poverty has not been reduced is shown by the continuing increase in the gap between rich and poor (Zweig, 2000). How then can we break this cycle that re/produces poverty and inequity? Freire (1971) showed that a transformative education has the potential to liberate people from the bonds of poverty, therefore allowing them to improve their social status and way of life. Transformative education, however, requires teachers ready to enact it. Hence, there is a need for a pool of suitably qualified teachers in urban schools, especially in those large cities with significant levels of poverty. There certainly are many dimensions to accomplishing this priority. In this article we focus on the education of teachers for urban schools.

The characteristics of urban schools make likely the necessity of employing a radically different approach from that successfully employed in preparing teachers for schools with students from middle- and upper-class settings. Such a different course is especially likely to be needed when the majority of students in an urban school are from the working class or from homes in which earnings are below the poverty line. Students in such circumstances might experience schooling as hegemony (Apple, 1979; Clarke, Hall, Jefferson, & Roberts, 1976). MacLeod (1995) graphically showed how the participation and achievement patterns (i.e., cultural production) of such students were a site for the reproduction of inequity and oppression. The ''hallway hangers'' in MacLeod's study rejected achievement ideology[1] instead of studying hard and participating in schooling, their activities included cutting class, shooting pool, drinking beer, and smoking pot. These activities predictably led to their failure to complete high school. Just as sobering was the pattern of achievement and participation of another group of working-class students, the ''brothers'' (McLeod, 1995). These African American males accepted the ideology of achievement; in contrast to the hallway hangers, they attended class and completed assignments studiously. However, despite their efforts most were not successful and did not proceed to college. This trend, in which students from working-class homes tend to remain in the working class despite their efforts to succeed, is of great concern in urban schools where the vast majority of the students might be from home circumstances framed by poverty. How can teachers and students in urban schools collaborate to identify potential sources of hegemony and to enact curricula that produce cultural forms that are liberatory and potentially transformative?

Cultural capital is an important concept. It describes the resources within a community that are desirable and beneficial and possess a high measure of integral worth (Bourdieu, 1992a; Sahlins, 1976). In addition to the material artifacts that surround us, these resources include social behavior, language, commonly held values, ethics, moral codes and socially ratified goals, aspirations and beliefs, and other factors that combine to constitute a cohesive, recognized group cultural identity. Bourdieu (1992a), Sahlins (1976), and Willis (1977) contend that students from upper-middle- and upper-class families possess a cultural advantage for achieving school-related success that lower-class students do not; schools tend to reward those who demonstrate knowledge and appreciation of upper-middle- and upper-class culture. This contention is supported by research on social class: the upper-middle-class model of success is the primary cultural norm in schools where students are devalued if they deviate from expected behavioral patterns (Eckert, 1989; Rothstein, 1993). For example, in the urban high schools studied by Eckert, interactional patterns of working-class youth differed significantly from those of middle-class youth, who found their own same-age preferences reinforced in the organization of schooling. In contrast, the multiage within- and across-family groupings of working-class and inner-city youth actively interfered with learning in schools, leading to further differentiation of the language particularities between middle- and working-class students.

Those interested in teaching largely live in and embody different, often incompatible social worlds from the students they are to teach, creating one of the great challenges for urban teaching and teacher education. Social structures, such as social class, cultural capital, and ethnicity, are major contributing factors to the re/production of middle-class values in schools and to the re/production of social inequities (Bourdieu & Passeron, 1979; Lamont & Lareau, 1988). The concept of cultural capital helps to explain how the cultural funds of knowledge, brought from students' home lives, provide a basis for making sense of what happens at school and constitute the building blocks on which new knowledge can grow (Lee, 1999). This capital includes all that students know and can do based on their sociocultural existence within communities that are saturated with practices and associated beliefs and values. Teachers often have little or no knowledge of what to expect from students who have lived part or all of their lives in circumstances of poverty (Barton, 2001). To teach successfully in an urban school in ways that are potentially transformative, teachers have to learn how to identify and connect with the social and cultural resources of their students.

The purpose of this article is to articulate our proposal for a form of teacher education that has shown great potential in preparing new teachers[2] for the challenges in urban schools. We begin by articulating the particular challenges presented by the nature of urban schools and the students who attend them. We subsequently present theoretical and empirical perspectives on our approach to teacher education in this setting, which we call "coteaching."[3] An ethnography of learning to teach follows in which we describe how Andrea, a new teacher at City High School and a coauthor of this article, enacted a curriculum intended to be culturally relevant for her Grade 9 African American students while enabling them to pursue the school district standards. We also provide several vignettes from a case study on coteaching involving the teaching and learning of genetics and the associated "cogenerative dialogues" (Eldon & Levin, 1991) about the praxis of teaching.

Approach to Teacher Education

Over the past 3 years the authors have redesigned the teacher education program at the University of Pennsylvania (known as Penn) to better prepare new teachers and to make use of their potential as transformative resources in urban schools. New teachers were encouraged to

learn to teach by coteaching with a peer or a cooperating teacher (a co-op). We wanted them to begin their teaching almost immediately—not to take control of an entire class but to teach at the elbow of the regular classroom teacher. We envisioned a peripheral (yet legitimate) participation in teaching and acknowledged from the outset that coteaching could be arranged differently in different places. In conversations with prospective teachers and coops we made it clear that coteaching involved teaching with another and that there were probably many ways to do this. In the course of our work we developed a coteaching heuristic by closely examining videotapes of coteaching involving new teachers, coops, supervisors, and researchers. Figure 1 lists some of the practices that occur during effective coteaching (Roth & Tobin, in press-a).

The concepts of being *with* others *in* a community, habitus, and *Spielraum* (i.e., room to maneuver; Roth, Masciotra, & Boyd, 1999) are salient to our enactment of coteaching in this study. For example, when university supervisors visited a class, we encouraged them to coteach with new teachers and their co-op rather than to effect evaluations from viewing teaching from the side or back of the classroom. In this way they developed new habitus, practice-generating dispositions, and associated room to maneuver. This form of participation enabled the supervisors to experience teaching and learning with *these* students in *this* place at *this* time and to facilitate cogenerative dialogues between coparticipants (i.e., from within).

1.0 Coplanning
2.0 Respect
3.0 Rapport
4.0 Creating Space
- 4.1 Willingess to step back
- 4.2 Step back
- 4.3 Willingness to step forward
- 4.4 Step forward
- 4.5 Tolerance of others' actions
- 4.6 Reciprocity
- 4.7 Anticipation of what is appropriate

5.0 Seamlessness
- 5.1 Conductor-less orchestration
- 5.2 Compensatory actions
- 5.3 Touching base
- 5.4 Divide and conquer
- 5.5 Coordinated action

6.0 Coparticipation Reciprocal/recursive
- 6.1 Upward trajectory
- 6.2 Playing off/tossing/parlaying/passing the baton
- 6.3 Overlapping talk
- 6.4 Finishing one another's sentences
- 6.5.0 Complementarity of action
  - 6.5.1 oral
  - 6.5.2 spatial
  - 6.5.3 gestural
  - 6.5.4 surveillance

Figure 1. Heuristic for teaching.

In cogenerative dialogues it is important not only to explain to each person what he or she might do to facilitate learning to teach but also why specific ways of participating are more likely to be beneficial than others. It is in the explication of why particular roles might be productive that theory and research findings can be used to advantage. Although we accept that there are multiple ways of participating appropriately with the goal of learning to teach, we also recognize that there are multiple ways of participating that will not be productive. Accordingly, it is desirable that discussions among participants *with* and *in* a community focus on the rationale for the most salient roles and associated modes of coparticipation. It is out of these discussions, or talk about praxis, that we see evolving a viable discourse, a local theory, or, as we prefer to call it (Roth, Lawless, & Tobin, in press), a *praxeology* (praxis + *logos*, talk). Learning communities, consisting of coops, new teachers, supervisors, and selected students develop praxis-relevant understandings rather than theories (which do not account for the particulars of a setting, which determine the suitability of each practical move).

1.0 Respect	Between participants
2.0 Rapport	
3.0 Inclusion of stakeholders	Student teachers, students, school personnel, high school students, university personnel.
4.0 Ways to participate	
4.1 Coordinate discussion	
4.2 Attentive listening	
4.3 Initiating dialogue/ideas	
4.4 Critical questioning	
4.5 Provide evidence	
4.6 Express an opinion (agree/disagree)	
4.7 Speak freely	
4.8 Clarify and elaborate on ideas	
4.9 Suggest alternatives	
4.10 Evaluate ideas and practices	
5.0 Opportunities to participate	
5.1 Equity/Level the playing field	
5.2 Space to participate	
5.3 Willingness to participate	
5.4 Invitations to participate	
5.5 Free of oppression	
6.0 Discussion topics	
6.1 Learning to teach	
6.2 Teaching and learning	
6.3 Curriculum	
6.4 Teaching kids like us	
6.5 Coteaching	
6.6 Transformative potential of activities/curriculum	
6.7 Links to particulars	
6.8 Quality of the learning environment	

Figure 2. Heuristic for discussions about praxis leading to a praxeology for teaching.

We analyzed video replays of discussions in which we attempted to construct locally relevant theory (praxeology) and developed a heuristic (Fig. 2) that contains a list of practices observed in dialogues that we considered both effective and cogenerative (Roth & Tobin, in press).

The Research Setting

City High School[4] has about 2,300 students arranged in 10 small learning communities (SLCs), which can be considered schools within schools, each with its own students, classrooms, and teachers. The idea behind an SLC is that students stay together with the same teachers over the duration of their high school lives, generating greater personalization of the curriculum, which will lead to higher achievement and a feeling of esprit de corps as a result of belonging to an SLC and getting to know the students and teachers. Of the students at City High 97% are Black, and 87% are from low-income families. Only 43% of City High students graduate in 4 years. Of the 10 SLCs, two intend to prepare students for college, whereas most of the others have career-oriented curricula. For example, students in the Health SLC often pursue health-oriented themes in their studies and regularly undertake field studies in health institutions. Most students in Health are female. The research described here took place in Health, where Andrea was assigned to coteach with Sonny, another new teacher, and with a co-op whom we refer to as Bert.

Research Method

In coteaching a unity between research and praxis is achieved because the members of the community are continuously engaged in transforming their praxis through critical analysis during debriefing sessions (Roth, Lawless, & Tobin, 2000). These debriefing sessions are characterized by cogenerative dialogue in which all participants, students, new teachers, cooperating teachers, supervisors, and researchers are enacting an equitable approach to making sense. These sessions are designed to develop local theory beginning with the primary experience, the understanding of which is developed through critical analysis. In this way the precepts of hermeneutic phenomenology (Ricoeur, 1991) and critical psychology (e.g., Holzkamp, 1983) are enacted, according to which immediate understanding has to be further developed so that new action possibilities arise for all participants.

Hermeneutic phenomenological analysis is based on an assumption that understanding associated with praxis and lived experience is primary. But, lest we remain stuck in a stagnant understanding and therefore a stagnant ideology, this understanding has to be developed through critical interrogation, which involves the expression of ''radical doubt'' (Bourdieu, 1992b) or ''suspicion of ideology'' (Markard, 1993). However, critical analysis itself is only possible because analysts already bring their primary understanding to the interpretive situation. Guba and Lincoln (1989) captured this approach in the notion of ''progressive subjectivity.''

In doing actual praxis data sources for analyses are constructed in the forms of videotapes, recorded debriefings, videotapes of the analysis sessions, reflections in journals, and face-to-face and e-mail interactions designed to further develop the new understanding and local theory. All results of earlier analysis are subsequently incorporated into analyses either as resources or as objects of inquiry on their own. In this way research results arise out of the recursive application of the hermeneutic phenomenological analysis, beginning with primary understandings and data, then with subsequent understandings and results. The goal of our analysis is to generate local theory (or praxeology) that provides new possibilities for action to the participants in the

research. Therefore, this form of research practice is authentic in the sense that it has an immediate application because outcomes are tested at once in the praxis of teaching and learning.

Our analysis does not attempt to achieve a unique understanding by means of triangulation or negotiation of differences, particularly if differences are outcomes of different social locations of individuals in the teaching–learning situation. For example, it may not make sense to achieve a consensus between a student and a university supervisor, or between a new teacher and a university researcher. For us, it is more important to understand such differences as the results of the different positionings in the overall teaching–learning system and therefore to understand these differences as the results of more global institutional structures (e.g., Dreier, 1991, 1993).

Presenting our argument in a literary form reflects the process by which we arrived at our understanding; this article embodies the very forms that led to its existence, thereby putting the construction of knowledge and its representation in a reflexive relationship (e.g., Ashmore, 1989). Thus, third-person accounts—consistent with the historically developed discourse of science education—are in contrast to first-person (autobiographical) accounts of the lived experience in the classroom and the immediate understandings arising from it. Furthermore, this article has a dialogue format, which is the structural equivalent of the way in which we analyzed primary understanding and developed it into local theory.

Learning to Teach Science Through Coteaching

From the very beginning Bert handed over the responsibility for planning to Andrea and Sonny. However, the teaching habitus that Andrea and Sonny had constructed from their experiences of schooling and teaching and, above all, of being learners was grounded in their middle-class experiences and was not all that useful at the beginning. As Andrea remarked:

> I learned a great deal as a result of my teaching at City High School. Even though I had taught in a suburban private school for 3 years prior to seeking my certification in biology and general science, I found from the outset that my teaching habitus was inappropriate in urban schools.

Because of Andrea's prior experience as a teacher in a private school, she was able to adapt her habitus to a greater extent than Sonny. Andrea seized the initiative, and before long her mark on the class was apparent. She planned thoroughly and was innovative in her efforts to create an environment in which students would be challenged and interested in science. However, from the following comment it is clear that at the outset Andrea was not enthusiastic about coteaching:

> Initially, I did not enjoy coteaching because I preferred to have control of my teaching. When someone came in, I regarded it as an interruption. Gradually, I warmed up to the idea of coteaching and now can see many benefits. I believe that the communal experience was of benefit to each of us. We learned to appreciate each other's talents and craft our individual praxis so that it best met the students' needs. What I learned through coteaching was that permitting others to openly critique and evaluate my pedagogy was the best resource for improving my teaching. After a lesson Sonny, Bert, and I would offer our critique and reflect on ways it could be improved. This open communication seemed to inspire each of us to try methods that previously we may have avoided.

Sonny also perceived the benefits of coteaching and expressed some reservations about the manner in which it was enacted:

> By being placed in a classroom with a fellow student teacher and a cooperating teacher, I was exposed to the coteaching environment for a semester. The obvious benefits of coteaching were that I was able to observe different styles and methods and learn from them. I was also able to share ideas about lesson plans and collaborate as a team. It was encouraging to have other teachers in the classroom for support and input and for the students to have a variety of teaching styles. The disadvantage to coteaching was the limited freedom I had in teaching certain material in certain ways. It is especially difficult when I did not agree with a specific method suggested and used by another teacher. The purpose of coteaching is to learn to teach by being in the presence of other teachers. I found this helpful when the coteachers gave me constructive comments on how I could improve my teaching.

In some senses Andrea and Sonny assessed coteaching in terms of receiving feedback, seeing different ways to teach, and having ideas on which to reflect. Given that they participated in coursework in which such ideas were discussed, it is no surprise they rated their experience in these terms. They did not examine videotapes to investigate trajectories of change in their teaching or to describe what was happening in relation to the advantages of *being in* an eventful classroom *with* other teachers. We see salience in their descriptions in two ways. First, as teacher-educators we should be clearer about the theoretical underpinnings of coteaching and provide indicators of what to look for in terms of changes in their teaching. Second, we need to focus the new teachers' attention on the development of a teaching habitus, which will be beyond written and oral descriptions. Evidence for the development of an appropriate teaching habitus will be seen in the establishment of classroom learning environments that feel better and operate according to how the coteachers feel they ought to operate.

Bert facilitated Andrea's teaching by being enthusiastic about her ideas, and Sonny provided support in enacting them. Andrea and Sonny were willing to enact teaching in ways that were consistent with the theoretical precepts discussed in their methods courses. Because Bert always was inclined to try something that made sense to him, the classroom environment was transformed during the fall semester. For example, the three teachers broke each 90-min class period into relatively short 15–20-min activities, and in an endeavor to maintain student focus and engagement, they set aside the initial activity each day for a ''problem of the day.'' This allowed students to review what they knew from previous lessons and settle down as they entered the classroom. Also, Andrea and Sonny responded to a school-wide emphasis on reading and literacy with a daily 15-min activity that focused on the creation of a vocabulary wall, in which essential scientific terms were mounted to enable students to focus on how to read and write them and to ensure they could provide definitions and use them appropriately in sentences.

In the second semester the three coteachers agreed to split a Grade 9 class, thereby enabling Andrea and Sonny to teach half a class each. Bert moved between the two adjacent classrooms, coteaching with both Sonny and Andrea. This arrangement, which was applied for one of the three 90-min periods, enabled Andrea and Sonny to coteach with Bert and also to gain experience in teaching alone. However, when other stakeholders visited each class, such as Michael and Ken, the number of coteachers increased.

Coteaching: A Closer Look

This section contains several vignettes from a lesson in which Andrea cotaught a biology lesson with Bert as her co-op, Ken as her supervisor, and Michael as a researcher. Sonny was teaching a similar lesson to half the class in an adjacent room. During the 90-min lesson Bert, Ken, and Michael cotaught in both rooms. The analyses in this section are based on videotapes

and transcriptions of verbal interactions from the classroom in which Andrea taught and an associated cogenerative discussion.

The first part of the lesson involved students spreading jelly onto bread and then testing the hypothesis that the bread always falls jelly side down. The students were very active and enjoyed the lesson immensely. Andrea was the lead teacher, and with the exception of coplanning, which did not occur in this lesson, every practice mentioned in the heuristic (Fig. 1) applied to the enacted lesson. We were all actively involved in facilitating the students' learning from their participation. However, the activity went overtime, and there was insufficient time for Andrea to complete the planned follow-up activities. Andrea suggested on the spot to review inheritance, phenotype, and genotype expressions, calculating them using the Punnett square, which Bert found an appropriate activity in the context of their overall curriculum. After a lengthy transition in which Andrea prepared some overhead transparencies for a review lesson, she commenced an activity on monohybrid crosses. The three coteachers present (Bert, Ken, Michael), all of whom were experienced though in different ways, were at various places in the classroom, attending to the unfolding lesson and prepared to contribute at the appropriate moment.

After a brief introduction in which the class reviewed the meaning of ''homozygous dominant,'' the following interaction occurred:

Andrea: Homozygous recessive means that there are two recessive genes. Keesha, come around.
Bert: A good way of remembering this . . . someone just said phenotype, genotype, and you gave the correct answer. An easy way of remembering this is . . . Just think of the first letter. A *p* for physical expression, for physical appearance; a *g* for the genes. So if you ever get confused, genes, genotype, physical expression, phenotype.
Andrea: All right, Keesha is going to put this on the overhead for us.
Keesha: [*Comes to front and completes the Punnett square for the problem posed.*]

While Keesha walked to the front in order to complete the Punnett square, Bert saw an opportunity to contribute something that would assist students in remembering how to relate the scientific terms of *phenotypes* and *genotypes* to their more familiar everyday language. Here, rather than chiding Andrea after the lesson for a long transition, the coteacher used a moment of transition as a ''teachable moment.'' Bert provided the students, who previously had been hesitant in answering Andrea's question about the different forms of expression (phenotype, genotype), with a mnemonic that would allow them to relate scientific terminology to words that are from their everyday language and that are therefore more familiar and easier to use. Bert, in effect, built a bridge between two forms of language, one that students bring to class and the other that is appropriate in the context of formal science. Such moments benefit not not only high school students but (new) teachers as well, who can learn how to better teach *this* subject matter to *these* students.

The following longer sequence shows the interactions that can arise when teachers are working together at one another's elbow.

Andrea: Now you did a wonderful job there with your Punnett square. Now, what percent have blue eyes and what percent are gonna have brown eyes?
Keesha: Fifty and 50.
Andrea: Good, now write that down.
Keesha: [*Writes*]

Bert: You know what another name for that is? When you really get into genetics? When you think of homozygous recessive? [*Pause*] And, in fact, what we are going to do is a test cross.
Ken: What is it called?
Andrea: Test cross.
Bert: Test cross. They are starting to determine genotypes.
Ken: [*Pointing to Michael*] Someone had a question.

In this excerpt an interplay can be seen between Andrea and Bert, both of whom are contributing to the lesson. Even Ken's question is a contribution, for there may well have been other participants who did not hear or know what Bert was referring to. Ken also facilitated Michael's entry into the conversation as a coteacher because neither Bert nor Andrea noticed that he had raised his hand to enter the conversation. Michael asked a question central to genetics but in a form that could easily be introduced into the classroom as a detective story.

Michael: I wonder if anyone can figure out a little bit about my family?
Andrea: OK?
Michael: So, I have blue eyes and my wife has blue eyes. I was wondering whether you can figure out what color my son Niels's eyes are?
Natasia: Blue eyes.
Michael: Why would they be blue?
Natasia: You have blue eyes, she has blue eyes . . .
Andrea: This is a good question.
Natasia: She has blue eyes, and you have blue eyes; you all must have recessive genes.
Andrea: OK, let's think about that [begins to write]. Let's list the possible . . .
Natasia: Make them have all the different combinations
Andrea: Excellent, excellent. [*In the direction of Michael*] A good point. I am glad you brought that up. Natasia has a good point. Let's list all the possible genotypes. OK. He has blue eyes. Question. So phenotype is blue. So what are the possible genotypes he may have? All right. What condition may he have?
Natasia: He would have to be recessive, because if, if, if all people . . . [*in the direction of Michael*] You all have blue eyes?
Michael: My wife and I both have blue eyes.
Andrea: This is the question.
Natasia: It has to be both recessive genes, because a dark color is dominant, like brown eyes would dominate over blue eyes.
Andrea: OK, so he would have to have . . . ?
Natasia: Recessive genes.
Andrea: All right [makes notes on overhead].
Natasia: So that would make all their genes recessive genes.

In this episode Michael, Andrea, and the student enacted a conversation. Michael did not allow Natasia to provide a simple answer but encouraged her to elaborate an explanation. This is a contrast to most of Andrea's verbal interactions with students in this and previous lessons. Later, Natasia showed evidence of her deep thinking when she asked Michael a question in an attempt to confirm her understanding of a prior contribution.

Although only one student was involved in this exchange, Natasia and Michael modeled the thinking and talking that led to a solution to the problem that was posed. This scenario is consistent with what we know about novices learning from experts thinking aloud as the new learners move toward a solution to a problem (e.g., Schoenfeld, 1985). Furthermore, in this vignette thinking in a social forum is not just accomplished by Michael for the benefit of Natasia.

The interactions occur in a social arena in which, in addition to Michael and Ken, there is a teacher, a new teacher, and a student, all of whom show evidence of active participation. All three contribute to the unfolding conversation, in the course of which a solution is the product of social interaction.

The situation constituted a moment of learning for the new teacher. Initially, Andrea stuck closely abstract notation (such as *b* and *B* for recessive and dominant) for calculations of Punnett squares and for problems involving genes. Sensing a need to get the students involved via a different route, Michael contributed a problem that seemed almost like a riddle suitable for other social situations. Given some information about his family, Michael asked students to make inferences about other members of his family.

Cogenerative Dialogues

Following the genetics lesson Andrea, Bert, Ken, and Michael, together with two student volunteers (Natasia and Shevon) participated in a cogenerative dialogue during which they discussed salient aspects of the lesson they had just shared. Ken initiated the conversation by remarking that it was an interesting lesson. Andrea followed up and identified some issues about student participation, issues she felt required further attention. She expressed a need to develop a strategy to get students actively involved at the beginning of a lesson. Based on her experiences with these students, she realized that to get the best out of them, her lessons needed to incorporate high levels of stimulation and energetic and lively interactions, consistent with the notion that African American students are likely to respond to tasks that have verve (Boykin, 1986).

The conversation changed course when Bert expressed satisfaction with the investigation of whether jelly on bread falls jelly side down or jelly side up. He liked the manner in which the students were involved in identifying and controlling variables. Ken was not so enthused and expressed what he called ''radical doubt.'' He was skeptical about the extent to which activities like this one got students involved in identifying, manipulating, and controlling variables. Andrea immediately defended the activity, explaining that she had just completed the biology praxis examination and needed to know a great deal about identification, control, and manipulation of variables. For this reason she perceived activities like this one as being significant to these students.

The initial conversations were relaxed and oriented toward generating issues that included classroom management, suspension of disruptive students, oral participation of students, coping with diverse ability, affective responses to science education, peer pressure, and grading. A conversation about sleepy students resulted in a sharp difference of opinion when Natasia suggested that the same kids sleep through all classes and that Andrea should just teach those who want to learn. Natasia's recommendation was consistent with one of Ken's concerns: that less time be spent on classroom management (Tobin, 2000). On this occasion Bert took the view that sleepy students should be aroused and encouraged to participate. The discussion was then extended to address the issue of how best to deal with diversity. Natasia suggested the formation of heterogeneous groups so that those who could do the work would teach those who could not. The conversation then addressed peer tutoring and debated the relative merits of different ways of arranging peer tutoring and coteaching. At one stage Michael suggested dividing the class into three, with Bert, Andrea, and Sonny each teaching a third.[5] Bert preferred this arrangement, but the students expressed a preference for leaving the class as an intact whole and having the three teachers do the teaching. Natasia and Shevon spoke convincingly in favor of three teachers teaching one class of 30 students, and for the moment Bert appeared to change his mind on the issue.

Culturally Relevant Curricula

The context of coteaching supported Andrea's development as a teacher, in particular, her development of practices appropriate for teaching in an urban school. That is, by working at the elbow of Bert, a 30-year veteran at the school, Andrea was able to develop culturally appropriate practices despite her middle-class origins. It has been suggested that if African Americans are to succeed in social institutions such as school, it is necessary that they integrate three divergent psychological realities that Boykin (1986) referred to as mainstream, minority, and Black cultural. Andrea, who adopted what might be referred to as a both/and approach to learning, to a significant extent stressed the mainstream interests in a science curriculum. For example, while emphasizing the school district's benchmarks, Andrea insisted that her science activities also connected with the lives of students. Most activities in Andrea's enacted science curriculum encouraged full participation of her African American students and created for them rich images of potential careers and further studies in science. In so doing, the students had opportunities to accomplish the benchmarks while studying a science that was interesting and potentially relevant. In addition, as is clear from the examples below, the science activities also catered to those psychological dispositions that often characterize the actions of African Americans (Boykin, 1986). These dispositions are similar to what we have describe in this article as habitus.

> One of the most influential bits of advice Bert offered me at the start of the school year was to learn to appreciate noise. He said, ''Noise can be a good thing; don't be afraid of it.'' After observing neighboring classrooms in which the teacher wasted an inordinate amount of time and energy by demanding absolute silence, I became especially appreciative of Bert's guidance. It seemed that it was not only difficult for African American students to remain quiet, but uncomfortable, even unnatural. Recognizing my students' propensity for making what I felt to be noise, I attempted to create science lessons that celebrated rather than squelched their vivacity. One such lesson was implemented in ninth-grade biology and focused on fertilization, pollination, and the parts of a flower. I deemed it necessary to thoroughly cover this material because it constituted a significant proportion of the school district standards and was to be covered on an upcoming citywide science exam.
>
> In what had seemed to me the most mundane of topics in my learning experience, I searched for a way to incorporate the students' love of performance into the instruction of standard botany. After having the students practice reproductive terminology by examining live flowers and sketching the events of cross and self-pollination, they had gained enough background knowledge to take the lead. They were given free domain of a table buried in craft supplies and given only one instruction: to develop a visual lesson that would teach younger students the principles of fertilization and the roles of male and female flower parts.
>
> The explosion of learning that resulted was phenomenal. Each student decided to work within a group. They utilized their notebooks and textbooks in order to create an informative and factually correct dialogue. Whether they developed a puppet show, parody of a sitcom, or ABC after-school special, the students were completely engaged in learning science.
>
> One group titled its presentation ''Plant Fertilization, Now That's Safe Sex'' and rapped their information while another group designed hand puppets and sang to their composition, ''The Flight of a Bumble Bee.'' When I accompanied this same class on City Beautification Day, I witnessed several students picking flowers and reciting the exact lyrics that their classmates had belted out nearly 3 months earlier.

Tacitly, Andrea was responsive to several of the salient categories of African American psychology (Boykin, 1986). For example, she gave all students opportunities to be emotional, expressive, and responsive by creating models intended to be aesthetically pleasing. In terms of verve, Andrea frequently involved students in high-energy activities in which they were required to represent what they had learned by building models, preparing posters for the wall, and teaching their understanding of science to others. She also encouraged a sense of community and social connectedness in her students by having them work in groups and by negotiating class rubrics for daily participation grades and rules for behavior. Because she believed in the importance of making it possible for students to be successful by representing what they learned in a variety of ways, individuals were encouraged to personalize their performance in science and to express their individualism.

> A good example of a lesson sequence in which students capitalized on their oral aptitude involved food, health, and nutrition. I commenced the lesson sequence with an investigation of the labels on food. I wanted to bring math into the process of reading food labels, an idea that was suggested by the students. Although I was initially dismayed by the students' math skills, they worked hard to figure out [the] percentages, fractions, and decimals required to complete their graphs. However, the students were interested in comparing the diets of Americans and Chinese. While they were completing their work, they had lengthy discussions about their own eating habits and how they could improve them. Students who finished early copied their graph onto an overhead transparency, and I invited them to present their information to the class. This set the scene as if it were a professional conference: the audience (including the principal) fired questions at the presenters, and students were permitted to participate in a mode in which most tended to excel.

Throughout the year there were many examples of Andrea making the curriculum relevant to the students and having them learn science that was potentially transformative to them. Perhaps the SLC theme of health facilitated this trend. The students were interested in learning about themselves and about issues associated with African American people. When Andrea questioned her students about how they would create their own culturally relevant biology curriculum, they identified crucial components as the labeling of food, heart disease, sex education, and the contributions of black scientists.

Metalogue

In the following, we chose metalogues[6] in lieu of a univocal discussion because using multiple voices has allowed us to retain differences about issues we all recognized as salient.

Coteaching in Urban Schools

> *Ken:* One of the big issues for me in setting up coteaching pairs was the extent to which new teachers could learn from one another. Because Andrea had taught in a private school before entering a teacher education degree program, she was quite experienced compared to Sonny. It was not surprising to see Bert and Andrea learn from one another to a greater extent than perhaps Sonny learned from either of them. I was perplexed throughout the first semester because it seemed to me that Sonny's role was too passive. She always seemed to be in the background and did not take her turn at stepping forward. When finally I took a stand and spoke to her, I was surprised to find that she was very pleased with her roles and

her learning. That discussion, plus others with Bert and Andrea about the same issue, catalyzed action, and a structure emerged in which each of the new teachers would take a turn of being a lead teacher.

Andrea: When we first began working with one another, it seemed that we automatically moved into the role that was most comfortable to us. Excited about the opportunity to teach in a new environment, I took the lead role, while Sonny preferred to observe. Bert was very supportive of our ideas and served as a coach, offering pep talks after difficult classes. Although our relationship was amiable, this arrangement was not the most conducive in terms of learning to teach from one another. Once Ken encouraged us to communicate our needs, we were able to develop an approach to teaching that we all participated in equally.

Ken: One of the most striking parts of this study has been the extent to which Andrea, Sonny, and Bert learned to teach by coteaching at one another's elbows. Over the course of a year I observed very significant shifts in the manner in which each of them taught. The changes were not necessarily made salient, and I am sure that in most cases they are beyond the level of conscious awareness. In addition, there also are issues that needed to be overcome that are somewhat endemic to urban schools, influencing everything that goes on within them. Do you have any examples of some of these?

Andrea: Unfortunately, violence affected my teaching on several occasions. What enabled me to divert these situations and avoid total disruption of the learning process was my coteaching experience with Bert. Having taught within the school for 30 years, and working as a disciplinarian for a third of that time, Bert was an expert at both defusing situations before they escalated into violence and managing them once they did. While it certainly put me more at ease to have an experienced man in the classroom, I did not look to Bert for help in handling altercations when I had taken the lead. Rather, I approached the situations in the same calm and concerned manner I had observed in his approach. If a disagreement between two girls, regarding perhaps which R&B artist was the superior dancer, was escalating into rage, I might have initially thought to say, ''Enough, girls. What you're arguing over is silly.'' What I learned by teaching with Bert is the importance of validating the perspectives of both girls, even if the topic is seemingly insignificant. Listening rather than blaming is crucial. As I spent more time coteaching in the classroom, I gradually became confident in dealing with aggression.

When I had the wind knocked out of my sails by a mother who had unexpectedly arrived in our classroom intending to physically harm the friends of her freshman daughter, the instructors and classmates of my science methods class revived me. The violence was so traumatizing to me that discussing it with others who had experienced similar situations was critical for my survival in that classroom. Although I do not believe it necessary for new teachers in urban settings to undergo a generic ''violence training course,'' I am adamant that a support network, such as the one provided by my science methods class, must be available to permit reflection on the topic.

Societal-Level Issues

Ken: The facilities available for teaching science at City High School are consistent with Anyon's description of ghetto schools.[7] Parts of the school are run-down, and there is a shortage of equipment and supplies.

Michael: These conditions are core data in the argument of critical educators[8] who use the concept of ''re/production'' in order to account for the fact that so little changes in education for minorities in general and African Americans in particular. So, what you are

articulating here are obstacles to teaching—you are articulating them at the level of lived experiences.

Andrea: I remember returning from my first day of student teaching and thinking, ''How am I going to teach science in such barren and gloomy conditions?'' Our 35 students were crammed into one classroom with no laboratory or even sink access. Brainstorming together, Sonny and I devoted several hours to decorating the room, not only to create a welcoming atmosphere but to surround the students with science as well. The walls looked festive and were continuous reminders of the students' mastery of science objectives. The themes Sonny and I collaborated on included a science vocabulary wall, science in the news, reaching our science goals, and several others. The lack of laboratory access was astounding to both Sonny and me, especially since several lab rooms were reserved for ''holding'' students, whose teachers were absent. It seemed that Bert had been so accustomed to this deficiency that it didn't concern him. After several months of listening to us bemoan the situation, Bert took action and informed the administration of our need for lab space. Although it took a while, we were eventually admitted into an ill-equipped yet functioning laboratory space.

Michael: It is not surprising for all of us think that teachers like us have to deal with the situation and deal with the ''obstacles'' to teaching and learning. A perspective from critical psychology[9] would be different. From this perspective we would argue that the obstacles are simply signs at an experience level for problems at the systemic level. That is, as we have learned from sociocultural approaches, the problems at the societal levels have been *internalized* and are now ascribed to problems at the individual level. Here, the problems are almost impossible to overcome other than in marginally making differences. Of course, we can apply this form of analysis to the students as well. In response to the systemic disregard for their primary discourses and the associated symbolic violence experienced by them, working- and underclass students will enact resistance.[10]

Andrea: The high rate of absenteeism at City High School, as with most urban schools, was a significant issue that I had to account for when planning my science lessons. On average, 20% of my class was truant, and those students who did attend arrived at various intervals following the scheduled start time.

Michael: I want to reiterate my previous point. What you are doing here by ''accounting for absenteeism'' is working around troubles created at a very different level. What happens is that you internalize societal problems and attempt to deal with them at an individual level. So we need to work in a different way, involving as we do students, new teachers, cooperating teachers, SLC coordinators, etc., in a cogenerative dialogue that deals with the systemic problems. That is, we have to articulate the structural problems at a collective level. In the meantime, we have to find ways and means that allow new teachers like Andrea to deal with these structural problems in a collective forum.

Learning From Dialogues

Michael: Cogenerative dialoguing after a shared lesson is, from my perspective, a crucial element in our coteaching design. In these discussions, in which the teachers and student representatives participate, we must not only attempt to understand our shared experience at an immediate level but to develop this understanding into local theory. On the basis of this new and generalized understanding, we are therefore developing new options for actions and therefore enlarging our room to maneuver.

Andrea: The initiation of cogenerative dialogues (by Ken), in which Bert, two or three students, and [I] reflected on a lesson, were so inspirational that I plan on continuing them at my new school. Most importantly, the conversations gave students a voice in the manner in which they were taught. Whether it involved a minor detail like their difficulty in discerning my *r* from my *n* or a major strategy such as pairing students as study partners, their feedback was a precious resource that aided me in designing lessons that best met their needs. I am convinced that students always serve as the best consultants.

Ken: I found these discussions about praxis an exciting aspect of our study that has great potential for bringing about change. Even though we had worked out the details of how to involve students, the co-op, and university supervisor in discussions about praxis, events unfolded in such a way that we did not seriously enact this part of our teacher education program until toward the end of the year. Even so, it was a significant step forward. I thought the conversations between the new teachers, co-op, and students were of particular significance. We had discussions with and without the students, and my impression is that they are an order of magnitude better when the students are there. We also had them with and without the co-op. I felt it was slightly better in most cases without the co-op being present. The students tended to be less restrained in their talk about praxis. However, one key advantage of having the co-op present is that the co-op can be a major beneficiary, in that issues that arise can be of [as] much significance to the co-op as to any of the stakeholders.

Andrea: I appreciated having all of the participants present during the cogenerative dialogues. On a few occasions a subject was introduced that had been troubling me yet was too embarrass[ing] to discuss with Bert or Sonny one on one. Having the students, supervisor, and coteachers available actually relieved the pressure because the issue could be addressed from various viewpoints, not just mine. The students also enjoyed the dialogue immensely. They would often request to participate in the meetings and were more inclined to approach us with their opinions about lessons after they had participated in a cogenerative discussion.

Ken: I think that we have good evidence for my claim of flattened hierarchies in the relationships between the various stakeholders. Looking back on the tapes, I am struck by the sophistication of the students' perspectives on what is happening in the classroom and the extent to which they can identify issues having salience to their learning and to the creation of productive learning environments. Of course, we all have to learn new roles within the discussions on praxis. There were times, for example, when I spoke, and it might just have been as well if I had remained silent. There also were times when the co-op tended to make statements that reified the traditional roles of teacher and student, in which the teacher ''instructs'' and the student listens and learns. Fortunately, we had students who seemed unafraid to speak and be heard.

Andrea: I never felt that one voice dominated the discussion. It seemed that the students appreciated their roles as consultants, and the teachers were very interested in what they had to offer. I think our experience with coteaching allowed this dialogue to be as comfortable as it was. Bert never acted as ''master'' nor treated Sonny and I as lowly apprentices. Rather, there was an even exchange of knowledge. Because of this arrangement we were willing not only to learn from one another but the students as well.

Michael: Shaking the behaviors that came with our traditional roles and our culture-specific habitus will be one of the central challenges. I have learned a lot and changed my own ways of interacting with others when I started to teach students from different cultures with very different interactional patterns. Providing space so that all participants can get

involved irrespective of their traditional ways of interacting is not easy, and we will all have to demonstrate a willingness to be sensitive to others.

Ken: The best way to set up a discussion on praxis depends very much on the circumstances. It seems essential that the teachers at the table should have cotaught. Maybe another way to say that is that all nonstudents at the table ought to have cotaught—that would include new teachers, coops, supervisors, researchers, and school administrators. I have a preference for two students because they can interact with one another and feed off one another's comments. When we had three students, it did not have the same dynamics. I am also concerned that we do not want too many adult coteachers in the group, although it seems fine to suggest that as many coteachers as there were could productively be involved. In this study we had Andrea, Bert, Michael, Ken, and two students. In fact, in most of the discussions on praxis in this study we had between 6 and 8 participants.

Changing Roles of Stakeholders

Andrea: There is no doubt that the coteaching arrangement provided the necessary support for me to succeed in the urban setting and improve my teaching in general. It was obvious from the beginning that my opinion mattered, as Bert, Sonny, and the students treated me as a valuable commodity. Starting from that foundation, I felt confident in trying new approaches and asking for honest critique, something that might have been intimidating if my role was solely as an observer and part-time participant.

Ken: As we have changed key parts of the teacher education program, it has been necessary to adapt the roles of the stakeholders. One of the most important changes is for new teachers to be researchers of their own and students' practices. This seems to me to be a logical extension of the coteaching and discussions about praxis. If new teachers are to optimize learning from their praxis, it seems that an ongoing program of research can only afford the growth in teaching.

Michael: It is only if all stakeholders are also researchers that we can aspire to new solutions to pressing problems. It is insufficient to generate new understandings and local theory if they do not lead to a change in the action possibilities. Whether a local theory has some merit has to be tested, right then and there, in praxis. Here, all participants have a role in contributing to theory development and testing and therefore to establishing the relevance of the work to the present situation.

Andrea: Taping myself during three situations—full-class lecture, small group, and individual discussion—was probably the most helpful assignment of the year. In my analysis I recognized that I allowed for practically no wait time and that I would ask simple questions. I also realized that I coddled the girls (led them right to the answers), while I expected the boys to find the answer for themselves. I was directly able to apply the results of this exercise to the classroom.

Curricula and Learning in Urban Schools

Ken: Andrea planned and enacted the curriculum in ways that she thought likely to connect with the psychological dispositions and habitus of her African American students. To the extent that she was successful in actually doing this, the students would have been disposed to act in ways that would afford their learning. A 2-by-2 matrix with conscious/unconscious as columns and intended/unintended as rows expresses what they can accomplish in such circumstances. What is salient in this is that students will participate and learn in ways that can be described by each of the four quadrants. Much of what they

learn will be unintended by them or the teacher, and much will be unconscious and therefore beyond oral and written description. This inevitably draws attention to the issue of whether or not there is value in what is unintended and unconscious. I maintain that there is enormous value in learning in this way and that the benefits are potentially valuable because of changes that may occur to a student's identity as a result of actively coparticipating in communities that are sciencelike.

Andrea: I made every effort to connect the curriculum to the life worlds of my students. Witnessing the battle several of my students waged with asthma, I incorporated a series of lessons focusing on the illness and its link to the African American population. In order to hypothesize about their race's disposition to asthma, the class examined trends in diet, living conditions, and geography, while simultaneously exploring its physiological effects.

Michael: Focusing on salient issues rather than on science content requires us to abandon traditional notions of science education. As my graduate student Stuart Lee and I observed in a study of one community,[11] when there are contentious issues, science is no more than a fiber in the thread of life. Thus, starting curriculum with salient issues in the life worlds of African American students may require many other issues to be addressed, including economics, politics, and culture.

Ken: Andrea and Sonny both made good-faith efforts to create a curriculum that began with what students knew and can do and what they were likely to enjoy. Then they made every effort to connect to the school district standards, which are closely aligned with the national standards. I really do worry about the priority for these students to learn science and question its transformative potential if we focus too much on preparing them for high-stakes tests in which they will no doubt perform at a lower level than White students and those from the suburbs. The cultural production associated with learning science of this type in these ways may be reproductive of the students' positions in social space. They may not be better off with good grades in science in terms of future employment or studies.

Michael: The problem I see in this is that school district standards and life worlds of African Americans are not necessarily commensurable. Teaching in a way to satisfy standards may be a tour de force under the best of circumstances and a contradiction in most situations.

Ken: Our theory of culture makes a difference as to how we look at what has happened in this study. We should not think of culture as only consisting of coherence but also as consisting of contradictions which coexist in a dialectical relationship with patterns of coherence.[12] The enactment of a science curriculum in an urban high school can be viewed as an institutional node, which becomes a site for the enactment of culture with its coherence and contradictions. We should expect struggle and resistance from students and efforts to create countercultures. Also we should look for and expect to see struggles of the students as they interact in a context of a dialectical relationship between their agency and social structure. Part of the social structure that is of concern is the hegemony that they accept as normal yet which is imposed by the dominant middle-class, Caucasian, and patriarchal culture. Resistance to hegemony can be seen as antagonistic to schools and what they represent, but I wonder whether it ought to be so. Are the students who resist freedom fighters whom we should admire, or are they cultural dopes enacting roles intended to reify their oppressed status? Just what role can science play in liberating those in our society who are oppressed and continue to be so because of their locations in social space?

Michael: I am not certain that current structures of schooling will allow us to move toward such a liberatory education because it is inconsistent with the interests that dominate in a

capitalist free-market political system. Personally, I believe that we need much more radical changes in the structures of schooling than we have been proposing so far. But coteaching/cogenerative dialoguing involving students as key stakeholders is certainly a beginning that allows us to deal with the most immediate issues teachers and students face in today's urban schools.

Possibilities and Impediments to Lasting Change

Possibilities

Coteaching or learning to teach by *being in* a teaching situation *with* another is clearly an opportunity to develop teaching habitus, which generates teaching practices. Bourdieu's poststructural perspective on knowledge suggests that some aspects of a practice such as teaching will be accessible to description by language. It is important to note, however, that much of a practice will resist description and that whatever is described orally or in writing is not knowledge of teaching per se: *knowing about* teaching is ontologically distinct from *knowing as* teaching. Knowing about is neither necessary nor sufficient as a condition for knowing to do something. Even so, it is important to describe teaching in a variety of ways, thereby creating conceptual objects subject to critical analysis.

It is through critical analysis that questions can be raised about actions and their relationship to hegemony. This is the point at which we have the greatest concerns about coteaching as a solution to the problem of educating teachers for urban schools. To develop a viable habitus, it is clear that coteaching leads to changes in teaching, changes that lead to learning environments that conform to what the coteachers and students prefer. Although compromises are necessary for the teachers and students to ascertain how a curriculum can be tailored to be consistent with students' own habitus, there is a grave problem that must be addressed. Just how do the coteachers and students know whether their actions are the result of their own agencies or of the cultural tides that propel them to act in ways that re/produce inequalities and maintain the oppression of African Americans from conditions of economic hardship? We are concerned that the coteachers and the students are likely to believe that they have agency and do what they want to do because of their own conscious intentions. In making such claims overtly or just feeling this way tacitly there is a danger that efforts will not be made to identify hegemonic forces and to examine the possibility that what they do is principally determined by hegemony rather than free will.

The problem of acting in accordance with hegemonic forces is ever present and can be addressed explicitly in cogenerative dialogues. However, this process only addresses those parts of teaching that can be described with language. To address those parts of teaching that are unconscious or that are internalized societal contradictions, it is desirable to have outsiders participate in coteaching. Hence, there is value in having two new teachers coteach and then changing the pairings throughout the year, allowing new teachers to coteach with a variety of outsiders. Thus, Ken and Michael are outsiders with considerable experience teaching in a variety of contexts. Even so, it has taken Ken more than 3 years to develop a teaching habitus that appears to be viable at City High (Tobin, 2000). Notably, his approach to teaching is quite distinctive compared with the teaching of veterans like Bert. Therefore, when Ken coteaches with new teachers there is a chance that the habitus created by the new teachers will be informed by Ken's actions, which are grounded in experiences both outside and inside City High.

We believe that different teaching habitus can be developed in different contexts within an urban high school. Hence, we have begun to vary the numbers of new teachers assigned to a class and the class size itself. We are now reluctant to divide classes, as was done when Andrea assumed control of half the class and Sonny the other. Although Bert cotaught with each teacher, the value of all three teachers learning by being with all the others was denied. Recently we have reduced class size to as few as 4–6 students and have had as many as three coteachers with such small classes. When the class size gets that small, some of the very pervasive issues in urban schools are diminished significantly. Therefore, there is less evidence of students sleeping, being inattentive, or creating disruptions. This allows new teachers to develop a teaching habitus that applies to contexts in which management issues are not (or not so much of) an issue. This habitus will operate in larger class settings, generating practices consistent with *these* students. Similarly, with larger classes we have assigned as many as three new teachers to coteach with a co-op, and so four coteachers routinely enact curriculum. With other stakeholders present, such as researchers and methods professors, the number of coteachers often involves six individuals. In these circumstances the coteachers and the students build viable habitus for teaching and learning, respectively, as myriad events unfold.

Both Andrea and Sonny developed an approach to curriculum planning and enactment that focused on building knowledge associated with the interests of students and what they knew and could do. Sonny succinctly summed up this position:

> While many consider the content standards of a curriculum to be of extreme importance, I believe that these content standards must be secondary in value to allowing students to develop the ability to think critically about the world around them. It is most effective to incorporate the content standards into a curriculum that approaches science from the perspective of questioning the world in which students live.

All coteachers have experienced significant difficulty in ascertaining what students know and can do and in building a curriculum that each student finds interesting and relevant to his or her life world. However, both Andrea and Sonny experienced success from the perspectives of key stakeholders including themselves, Ken, Michael, Bert, and the students. The students found the classes taught by Andrea and Sonny to be interesting and challenging, and they felt as if they learned a great deal. However, whether what they have learned transformative is an issue that must be raised.

Impediments to Significant Change

Despite many or even most students trying hard for both Andrea and Sonny, the pervasive problems of urban education still affected the students' learning. For example, more often than not the pace of the enacted curriculum at City High would be considered agonizingly slow at a middle-class school. Even so, there were students like Natasia who were quick and managed to learn in ways that suggested a deep knowledge of topics such as dihybrid crosses in genetics. But how does this knowledge translate into an improved place in social space? Will Natasia graduate from high school and become a doctor, which is her goal? Natasia's academic performance in Andrea's class suggests she has the potential to do so. However, since our research, Natasia's world changed dramatically, impeding the realization of the potential she had shown.

In the summer following the research in Natasia's class, nine individuals moved into the home that she shared with her mother and sister. Natasia, who had the responsibility of tidying

the house and preparing meals, suddenly was faced with enormous challenges, resulting in high levels of stress, manifested in numerous ways, including: absence from school, failure to complete homework, acute tiredness (hence, sleeping in class), aggressive behavior toward peers, and an apparent lack of motivation to succeed. Furthermore, she began to publicly articulate her individuality in the way she dressed and presented herself (new hairstyles, wigs, dyes, and finally a cleanly shaved head). Natasia failed English and was showing no interest in physical science. At this point we worked to get her transferred into a biochemistry class of six students cotaught by two new teachers without a co-op teacher.

The individualized attention possible in this smaller class allowed Natasia to participate actively in science anew, to develop an interest in the activities, and to quickly become a high achiever once again. Participation in the cogenerative dialoguing also enabled her to identify aspects of her own participation as a learner that had to change. Of course, we would like to think our intervention provided Natasia with the break she needed to withstand the hegemonic forces of capitalism in which African Americans are oppressed and disadvantaged by the ideologies of achievement and capitalism. We are concerned that the hegemony is vast and beyond what we have described here or have identified in our study. Our experiences are no grounds for optimism. What guarantee do we have that curricula of the types enacted by Andrea and Sonny are transformative and provide the students with the cultural capital that can propel them to a more advantageous spot in social space? Is it desirable to focus on school district standards, or are these standards part of the hegemony?

We believe that national standards are a component of hegemony, which maintains achievement gaps between Whites and African Americans. We wonder whether Andrea and Sonny might have focused more on providing students with opportunities to craft science-related identities through their participation in science. If students were to develop a scientific habitus, would this benefit them in their life worlds, and would it enable them to improve their social circumstances? We do not have ready answers to these questions. However, we have seen how the placement of new teachers in an SLC can lead to profoundly different enacted curricula. We have also seen that our policy of regarding new teachers as human resources, making it possible to afford different ways of assigning students to classes, has resulted in very significant changes. We regard most of these changes as highly positive and feel the interests of the students are being met more often than not. What is clear, though, is that actions of all participants at City High are driven by hegemonic forces that saturate policy and practice. It is not possible for us to enact changes of the magnitude necessary to catalyze the reforms needed to rejuvenate urban science education. Are our students analogous to MacLeod's ''brothers,'' who worked hard to succeed academically only to find that their efforts did not produce social or economic advantages for them? Are our coteachers unwittingly participating in cycles of social reproduction? Questions such as these are necessarily a part of any teacher education program that seeks to produce teachers for urban schools.

Notes

[1]Hard work at school leads to higher achievement that will then create opportunities for higher study and a greater range of employment options.

[2]Persons seeking certification to teach science often are referred to as ''student teacher,'' ''prospective teacher,'' or ''intern.'' We prefer the term ''new teacher'' because it is descriptive of their role when assigned to field experiences. The term is also more consistent with our idea of teaching and learning to teach as a trajectory of ''legitimate peripheral participation'' (Lave & Wenger, 1991) in the educational community.

[3]Coteaching is grounded in a phenomenological epistemology and differs from ''team teaching'' in its explicit focus on *being together with* as a fundamental condition of knowing and learning to teach (Roth, Masciotra, & Boyd, 1999; Roth & Tobin, in press-a, in press-b). Accordingly, coteachers do not divide up tasks, as often occurs in team teaching, but teach together, though the role of the lead person shifts according to the circumstances.

[4]All names for persons and places are pseudonyms (except for the authors).

[5]This is actually what had been done.

[6]According to Bateson (1972), metalogues are conversations in which previous texts and dialogues are brought to a new, more general level by abstracting themes from previous accomplishments. Metalogues are reflexive of the dialogic manner in which we make sense as researchers and coteachers.

[7]Anyon, 1997.

[8]Pinar & Bowers, 1992.

[9]Dreier, 1991; Holzkamp, 1983.

[10]Willis, 1977.

[11]Roth & Lee, 2001.

[12]Sewell, 1999.

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