IMPROVING THE TEACHING AND LEARNING OF SCIENCE IN A SUBURBAN JUNIOR HIGH SCHOOL ON LONG ISLAND: ACHIEVING PARITY THROUGH COGENERATIVE DIALOGUES

by

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ABSTRACT

IMPROVING THE TEACHING AND LEARNING OF SCIENCE IN A SUBURBAN JUNIOR HIGH SCHOOL ON LONG ISLAND: ACHIEVING PARITY THROUGH COGENERATIVE DIALOGUES

By

Eileen Perman Baker

Advisor: Kenneth Tobin

The research in this dissertation focuses on ways to improve the teaching and learning of science in a suburban junior high school on Long Island, New York. The study is my attempt to find ways to achieve parity in my classroom in terms of success in science. The goal of parity is for all students to have equal opportunity to enjoy a basic education of high quality, achieve at high levels, and enjoy equal benefits from education. I was specifically looking for ways to encourage Black female students in my classroom and in other classrooms to continue their science education into the upper grades. The participants were the 27 students in the class, a friend of one of the students, and I, as the teacher-researcher. In order to examine the ways in which structure mediates the social and historical contexts of experiences in relation to teacher and student practices in the classroom, I used collaborative research; autobiographical reflection; the sociology of emotions; immigration, racialization, and ethnicity, and cogenerative dialogues (hereinafter, *cogens*, singular *cogen*) as tools. Cogenerative dialogues are a way for students and

teachers to accept shared responsibility for teaching and learning. This study is of importance because of my school's very diverse student body. The school has a large minority population and therefore shares many of the characteristics of urban schools. In my study I look at why there are so few Black female students in the advanced science courses offered by our district and how this problem can be addressed.

I used a variety of qualitative approaches including critical ethnography and micro analysis to study the teaching and learning of science. In addition to the usual observational, methodological, and theoretical field notes, I videotaped and audiotaped lessons and had discussions with students and teachers, one-on-one and in groups. In the first year the cogenerative group consisted of two Black female students. In the second year of the study there were four Black and one White-Hispanic female students in the cogen group.

Below, I discuss my journey toward a career in science education and explain how I became a teacher-researcher. In my research I studied the interactions of the students between lessons and during laboratory activities as well as the cogens themselves in order to get the data needed to identify the role of science cogens in the learning and teaching of science. The students both in my cogen and in my science class collaborated with me as we worked to create new culture through conversations. I also used cogens to examine the influence of immigration, race, ethnicity, and gender in my science class.

The students in the cogen were native-born children of immigrants, known as the second generation and/or 1.5 generation. In the first year one of these students was the daughter of Jamaican-born parents and the other native Black. The students in the second year included one each of Haitian and Jamaican descent, one with Dominican parents, and two native Blacks. Interestingly enough, if I had not conducted the cogenerative dialogues, I might never have

become aware of their ethnicities. The cogens helped me to become a better teacher by allowing me to understand what racialization was and how it impacted students as well as teachers. The cogens helped students voice their opinions in a manner and in a place that supported their understanding of both the similarities and differences among students in the class in addition to contradictions in their science class as well as in other nested fields. Contradictions are differences between people and groups that arise as a normal part of social life in the classroom (and elsewhere, of course), and I looked for ways to retain these differences as we learned to deal with them. I looked especially for contradictions that were evident between the larger culture of the school and that of the students in the cogen.

I studied the dialectical relationship between agency and structure in my science class and within the cogenerative dialogue group. I found that as students gained agency, they were more successful in obtaining entry into accelerated science classes and succeeded in those classes. I found that some marginalized students were shut down in their classrooms. During the common planning time within the science department, we discussed the lack of minority students in our advanced science classes. I introduced the idea of cogens and described how they could encourage more students to become involved in the process of learning. Although my colleagues did not institute cogens with their students, they did listen to the ideas about culturally relevant teaching which I communicated, and, although I have not witnessed it myself, I was told by some of my colleagues that they were trying to address the cultural mismatch found in their classrooms. The science faculty and I spoke to administrative personnel, and they saw how their goals and ours were aligned. Soon, all stakeholders were on board: my chairperson, the science department, and the administration.

For many Black female students in our district, access to advanced science classes was largely unavailable because students had not learned to communicate scientific literacy in ways that were recognized and acknowledged in our school district. My research supports the theory and research that point to the desirability of building positive emotional energy through chains of interactions and transactions that produce success among most, if not all, participants.

This study increases the understanding of the structure of interactions in a science class by building understanding of the face-to-face encounters associated with organizing, establishing, and maintaining conversations. As a teacher-researcher, I found that cogenerative dialogues also helped to create emotional energy and student engagement as well as synchrony and entrainment among students in the cogen and in the classroom. A community of learners formed, and this contributed to a positive learning environment. This environment in turn produced positive emotional energy and community. Cogenerative dialogues became a tool to build community in my science class. It also became a tool to introduce a new way of teaching and learning to me as well as to my colleagues. I began discussing the use of cogens in my science department meetings so that, by understanding different ways of thinking and being, my colleagues and I might find ways to transform science education at our school. Becoming aware is an important step for teachers and students to use their cultural capital to eliminate practices that prevent students from connecting with science. In cogens teachers and students can identify important shared classroom experiences and together fashion new roles for each of them.

Teacher-researchers can effect change in their classrooms and, by letting others in the school and academic community become aware of their research, effect change in other schools as well. The results of the latest Regents exam have convinced the administration, the math, and the science departments as well as other faculty members of my junior high school that, when all

stakeholders are involved, change can happen. The students who had been marginalized were as successful in the advanced science classes as those who were not. My school district took note of this and proudly continues the program.

Dedicated to:

My children, companion, family, friends, students and colleagues at my junior high school, colleagues in urban education, my own teachers, and the rest of our community.

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Chapter 1

Examining How Structure Relates to the Social and Historical Contexts of Lived Experience in the Classroom

This dissertation discusses an experimental approach to improving the teaching and learning of science. Specifically, I used a number of methods in an attempt to help female minority students at a diverse suburban junior high school to achieve parity with their peers in terms of success in science and to continue their science education in the upper grades. Students such as those in my study are historically underrepresented in advanced science classes both nationally and internationally. Advanced science classes can lead to careers in science, which can be one pathway to economic success. All students should be able to have access to these classes.

As a teacher-researcher, I participated in the study along with 28 Grade Eight students. I used collaborative research, autobiographical reflection, and cogens as tools in my attempt to elicit better outcomes in science education for female minority students within a theoretical framework informed by the sociology of emotions, immigration, racialization, and ethnicity.

The Plan for My Research

This study is of importance because its findings are broadly applicable to addressing achievement deficits in minority and immigrant populations in schools across America, especially in urban areas. My school, because of its very diverse student body, shares many characteristics with urban schools. A large percentage of minority students are in the school district. The impetus for this study was a desire to examine why immigrant and native-born Black female students disproportionately failed to enroll in the advanced science classes

offered at my school on Long Island, New York (hereafter referred to as Suburban Junior High.) In a school that claimed, as this one did, to value diversity, how did this come to pass? One way to examine the causes is to consider relevant responses from the students themselves through cogens and tracking their progress and attitudes over the two years this study took place.

Cogens were introduced as a way to improve the teaching and learning of science at City High in Philadelphia in the 1990's. Kenneth Tobin was searching for a way to reach urban students by creating a structure in which he could establish and maintain solidarity in the classroom. In this way he hoped that students would develop identities as science learners. Since then, researchers have used cogens to do exactly what Professor Tobin had wanted to accomplish--creating solidarity among students and helping them develop identities as science learners.

Research requires data collection. To collect data about cogens, teacher-researchers have been videotaping and audiotaping lessons and cogenerative dialogues themselves. Woolf-Michael Roth (2007) discusses the importance of videotape and audiotape as a tool in the science classroom. "It is precisely in and through the utterances and other communication forms that the participants make available and salient the sense of the situation" (Roth, 2007, p. 117).

As a teacher researcher in my classroom, I positioned the camera on a desk or walked around with it in order to capture different forms of interactions as they occurred. Occasionally a student would do the videotaping instead of me. This student was proactive, moving around the room as students participated in lab activities or discussions. He was able to move quickly from group to group. Using this technique, I was able to follow my students as they shifted

their attention through different fields. As I zoomed in, I was able to see a microcosm of social life and the dynamics of the culture of the classroom. As I conducted my research, I realized that my role as a teacher-researcher (as well as my understanding that my set of life lessons were in many ways different than those of my students) might distort or prejudice my objectivity. I used a variety of research methods, including critical ethnography and micro-analytic approaches, to study the teaching and learning of science (Roth, 2005). I acted as a participant-observer in an auto/ethnography, using field notes supplemented by video and audio recordings of lessons as well as by discussions with students and the teachers in my science department. As I participated as an ethnographer and teacher, I replayed digital videotape to identify vignettes that were salient to my research questions. These questions included finding out why the way school science is typically taught perpetuates social inequities, intergenerational poverty, and the social and economic isolation of marginalized students even in schools like mine which feature excellent laboratories and teachers with certifications in their science specialties. Is it because students who bring their knowledge, values, and interests into their classrooms are often shut down, undermined, or ignored?

I wanted to find out whether cogens could help marginalized female students succeed in advanced science classes at our junior high school, whether these students could become more agentic and interested in science, and whether using culturally relevant teaching could help diminish the mismatch between the culture of many marginalized students and that of the mainstream educational environment in my school. I had some students who performed very well and others who performed badly, but my ultimate comparisons were based on comparing my students to indices that measured achievement in Black students as well as all students as a whole.

I analyzed the selected vignettes by slowing down and speeding up replay of the tape, moving image-by-image to analyze interactions at the micro-level. In this way I observed practices and contradictions that could not be understood in real time. Contradictions are differences between individuals and groups and between individuals and some specific culture or general condition and are part of the complexity of interactions. They provide for the possibilities of agency which allows for the formation of student's identities. I transcribed episodes so that I could analyze the discourse. I selected video frames looking for salient features including body orientation, eye gaze, facial expression, and gesture. This process of analyzing these factors in the students' interactions enabled me to determine whether students were actively taking part in the lessons, joining with each other in mutual focus, and creating solidarity during the lessons (Collins, 2004). Producing and sustaining solidarity involves continuous effort, not just from the students who are the targeted population but the also from the collective (Turner, 2002). Mutual focus and solidarity is beneficial to the desired outcome of expanding the roles of students, listening to them, and focusing on improving the emotional climate (Tobin, 2009).

As I analyzed the tapes, I was able to see how the students did and did not cooperate with each other. I was able to see how they formed their identities and worked within the community of the classroom in verbal and nonverbal ways. I could see how my students and I participated in multiple fields within the classroom. As I walked around the room with the camera, I was able to capture movements, sounds, and conversations, which were then analyzed at a later time with my cogen group.

The cogen group and I met three times a week during lunchtime in my room where the video analysis took place. During the second year the group was made up of five female

students. Karen was of Jamaican ethnicity, Beautiful and Torie were American Black, Krystal was Dominican, and Shantelle was Haitian. Although this group is not representative of the district's demographics, it is representative of the marginalized students in the district. As we studied the successful and unsuccessful interactions in my classroom, I was able to also identify contradictions within structures in the classroom, and I found ways to alter those structures and expand the agency of all stakeholders. Structures are factors such as class, gender, ethnicity, and culture which may limit as well as influence the opportunities that individuals have (Bourdieu, 1986).

As I studied those characteristics I was looking for ways that my students could change the social structures with which they were familiar. I looked for and supported findings on micro-, meso-, and macroscopic levels. I elicited ways to show how participants' actions transformed the structures associated with the school and the classroom.

I followed Egon Guba and Yvonne Lincoln's (1989) authenticity criteria, whereby the researcher looks for patterns and contradictions that arise as culture is enacted within fields. Guba and Lincoln felt that research that benefits the stakeholders in the study also leads to improvement both as the research is conducted and in the future. These qualitative researchers defined ontological authenticity as the way in which participants in a study change their perceptions of the way social life is enacted. With educative authenticity the beneficial changes due to research in the classroom are sustained. All stakeholders need to understand how others experience and make sense of social life. Catalytic authenticity occurs when there are positive changes for stakeholders in the study. Stakeholders are educated and agentically learn to improve the quality of their social lives as well as the fields in which they participate. Tactical authenticity empowers stakeholders to make changes. In my classroom and in my school

district, providing ontological, educative, catalytic, and tactical criteria to bring about changes broke cycles of reproduction.

Success in Science is Important for Marginalized Students

Students in today's educational climate need to achieve at academic levels that at one time were expected of only the best and brightest students (Suburban Quick Facts, 2005). If educators are serious about leaving no child behind, they must close the gaps in achievement that exist between poor and minority children and their peers, recognizing that with high expectations comes a responsibility to insure that every child gets the support needed for success (Suburban Quick Facts, 2005). Students who are the most culturally and economically marginalized have fewer opportunities for success in school science as well as fewer opportunities to pursue higher education and careers in science, mathematics, technology, and engineering due to the academic requirements of New York State's education system.

In New York State students have three high school diploma options: the standard High School Diploma, the Regents Diploma, and the Regents Diploma with Honors (NYS Department of Education, 2005). These vary in the number and types of credits needed for graduation, the number of Regents exams one must pass, and the cutoff scores for passing the exams. The Regents diploma is intended for more advanced students, adding to the basic requirement a year of a foreign language study; additional language arts electives; and passing scores on Regents exams in English, science, math and social studies. New York's state colleges and universities require incoming students to have completed the Regents diploma or comparable requirements, meaning that students who do not choose to take advanced courses in high school are effectively excluded from affordable higher education.

Suburban School District (A Pseudonym)

I was a teacher-researcher employed in a school district on Long Island. According to the U.S. Census of 2000, the district in which my school is located had family incomes as low as $54,250 and as high as $85,916. Although this is above the poverty line and the national medium, Long Island has a high cost-of-living.

Long Island is popularly regarded as an enclave of the rich and the middle class; however, its demographics are rapidly changing due to immigration, and it contains pockets of poverty as well. The school at which I taught drew part of its student body from one of these pockets. The district as a whole demographically was 60 % White, 20% Black, 15% Hispanic, 4.2% Asian, 0.3% American Indian, and 0.5% multiracial. This results in a student body that is ethnically and socioeconomically similar to that of an urban school in a disadvantaged area. In our school district with its diverse school population, all students should theoretically be able to access everything our district has to offer, but many more White students than minority students take advantage of these opportunities and utilize the available resources.

A High-Needs School

In high-needs American school districts the staff and administration need to provide academic and social tools to low-income students so that they can overcome obstacles that have traditionally prevented them from achieving their full long-term, educational, and professional potentials. Suburban School District is considered a high-needs district, and its number of at-risk students continues to grow. Between 2000 and 2004 the percentage of Long Island students living below the poverty level increased 29% in high-needs districts with close to one in five children in those districts living in poverty (Long Island Index, 2005). Suburban School District is one of the largest school districts on Long Island. In the 2005-2006 school year it

had a total enrollment of nearly 10,000. This figure is made less specific for the sake of anonymity, and Suburban Junior High has nearly 1,500 students in grades 7-8. 35% of students districtwide receive reduced-cost or free lunch (Suburban Quick Facts, 2005).

Seventy-seven percent of Suburban graduates earned a Regents diploma in 2005, up from 36% in 2001. This signifies that substantial steps had already been taken to improve the educational quality in Suburban School District at the start of my research. However, the Black population in our school still consistently scored below the rest of the school population on the yearly 8th grade State science exam. Science department meetings regularly discussed the need to bridge the school's achievement gap, and, in the course of investigating the causes for this performance gap, it came to light that over a number of years Black students were consistently underrepresented in our non-mandatory advanced science classes.

As these discussions at the science meetings continued, I realized that I could make a difference in my school district by organizing cogens in my classroom. I explained the current research on cogens at the CUNY Graduate Center to the science faculty. In Chapter 4 of this dissertation, I explain in more detail the work being done studying the use of cogenerative dialogues. Generally, cogens offer a place to interact successfully while synchronously cogenerating outcomes and shared responsibilities for enacting these outcomes (Tobin, 2007). Cogens offer a greater sense of solidarity because of the emotions associated with being with others in the group.

Participation leading to solidarity in the classroom can transform the learning environment through the resolution of contradictions (Tobin, 2007). Differences are associated with contradictions that may appear as resistance and can lead to unsuccessful interactions between the participants in the class (Tobin, 2007). Cogens allow teachers and students to learn

to interact successfully. What is learned in a cogen is then enacted in the classroom to improve the quality of teaching and learning.

The science faculty agreed that cogens might be a way to help teachers and students understand each others' worlds better and encourage students to use their capital in the classroom as a way to access the resources available to them. Capital is the experience that people bring with them into any situation. As I developed this proposal, I contacted the administration in my school district. They were very cooperative and approved the proposal, which they felt was aligned with their goal of closing the achievement gap. They were interested to see how the use of cogens could help our Black students improve their science experiences and succeed in science classes as well as stimulate these students' desire to enter the advanced science classes that were available to them but underutilized.

Goals of Suburban Junior High

One of the goals in the Suburban School District was to improve the scores and academic achievement of its diverse community of students. The Black population had consistently scored below minimum standards in science at both the 4^{th} and 8^{th} grade levels in the district. Female Black students, the population I had decided to research, had little success in improving their scores--especially in the sciences--as they tried to advance academically in the district.

According to a pamphlet issued by Suburban School District (Suburban Quick Facts, 2005), enrollment in college-level Advanced Placement (AP) courses and pass rates for AP exams was on the rise at Suburban High. Unfortunately, very few of these students were minority or at-risk students. In the four AP science courses offered in the district, the total number of Black female students was 5 out of a total enrollment of 127. Since the Black population at the junior high school was about 20% and females were half of the enrollment,

female Black students were underrepresented in these AP science classes. In addition, Suburban Junior High School had advanced science classes in the eighth grade. Based on records kept in the guidance department at my school, I found out that in 2005, out of the 60 students who enrolled in advanced science classes, the school had five Black female students enrolled, an improvement over the previous year in which only one Black female student enrolled in advanced science. In 2009 there were 120 students enrolled, and 22 were Black female students. This was after my research and approached expected norms.

School Science Perpetuates Social Inequities

Unfortunately, the way school science is typically taught perpetuates social inequities, intergenerational poverty, and the social and economic isolation of marginalized students (Elmesky, 2005). This is true regardless of the resources available at the school in question. Why should this happen in schools that feature excellent laboratories and teachers with certifications in their science specialties? Is it because students who bring their knowledge, values, and interests into their classrooms are often shut down, undermined, or ignored?

For marginalized students manners of interacting, communicating, moving, or simply being are often at odds with those behaviors expected in a typical science classroom. Frequently, this leads to such students experiencing what Pierre Bourdieu (1992) termed *symbolic violence* at the hands of teachers and administrators. Symbolic violence is the enactment of cultural and social domination in tacit, almost unconscious ways in the course of everyday social interactions. Bourdieu (1992) believed that symbolic violence maintains a system of power by means of the transmission of a dominant culture. Symbolic violence may be discriminatory or injurious to students because students may believe that the dominant position is the only right one. Students can feel that their capital is not appreciated or understood. The use of cogens and my experimental teaching approach attempted to eliminate

symbolic violence in the classroom. Students were provided with a place where their cultural capital empowered them.

An incident of symbolic violence which I enacted in my own classroom before I began my courses at the Graduate Center arose from my discomfort with the way some students failed to look me in the eye when we conversed. Interpreting their refusal to meet my gaze as a lack of attention or interest, I insisted on eye contact while talking, but they frequently demurred, and I frequently criticized their refusal. Eventually, during another such incident, other students in the class informed me that, in the culture of the student I was criticizing, looking down and not making eye contact was a sign of respect. By insisting that students look me in the eye when I spoke to them, I was inadvertently inflicting symbolic violence. I was assuming that my way of determining respect was the correct way. The power dynamic being played out made me the perpetrator of symbolic violence and my student the victim. I was maintaining the dominant culture and trying to impose the dominant culture on my student. Symbolic violence is also intertwined with social and cultural capital (Bourdieu, 1992). Whereas social capital is found in the connections within and between social networks and individuals, cultural capital is found in the knowledge, experience, and connections people have during their lifetimes that enable them to succeed more so than others who have less-experienced backgrounds. The structures in which social relations take place are known as *fields*. Bourdieu (1986) also talks about *habitus*, dispositions found in the group but that manifest themselves differently for each individual.

When marginalized students attempt to access science as a tool for empowerment, they may be denied equal access because their ways of behaving and articulating answers and questions in a science classroom are seen as inappropriate and are therefore ignored or

disdained. Teachers and students often have difficulty anticipating others' cultural enactments. They may not interact in ways that are timely or appropriate to the situation, which can result in a high incidence of unsuccessful interactions. Such experiences can lead to negative emotions including frustration and disinterest in learning. Science education for Black female students in Suburban School District may remain inaccessible because these students have not learned to communicate scientific literacy in ways that the district recognizes and acknowledges as positive.

Although in the halls students self-segregated according to race and ethnicity, in my classroom I noticed much less of this. My classroom provided a field within which students could access knowledge about each other and communicate through dialogues using their own cultural resources. Students needed to feel free to use their capital (social, symbolic, and cultural) in the classroom as a way to access the resources that were available to them. It is important for teachers and students to learn to communicate across boundaries (Tobin, 2006).

Aligning the Cultures of Teaching and Learning

Important issues arise from teaching and learning to teach. There is a dialectical tension that comes from enhancing students' opportunities to learn science in an atmosphere that is very different from the teacher's. Inequities that arise from these cultural differences need to be altered and transformed, not reproduced. Teachers and students need to learn how to interact successfully in ways that produce a sense of belonging to the class and a commitment to shared responsibility for one another's participation. Aligning the cultures of teacher and learner increases the fluency of interactions in the classroom, which in turn increases the chances for success and facilitates learning (Tobin, 2006).

When educators discuss the teaching and learning of science, they need to focus on the ways in which teachers and students access and interact with classroom structures. Changing an approach to teaching is not easy. Learning is cultural production. In my study I examined how the dialectical relationship between agency and structure evolved in my science class and within the cogen group that was formed. In a cogen there is a dialectical relationship that is established between the individual and the group. To feel they have agency, students as well as teachers need to be able to access structures that will enable them to be successful in social life. In a cogen students have the opportunity to enact agency and to progress with individual goals. The cogen provides a structure that also makes possible the goals of the group.

If teaching and learning are not aligned in our district, one way to accomplish the goal of increased minority participation in upper-level science classes may be cogens (Tobin, 2002). I began discussing the use of cogens in my science department meetings by understanding different ways of thinking and being. Becoming aware is an important step for teachers and students to use their cultural capital to eliminate practices that prevent students from connecting with science. In cogens teachers and students can identify salient issues from shared classroom experiences and cogenerate new roles (Roth & Tobin, 2001).

Trying to Change the Power Structure

In these meetings we discussed how students could use their social and cultural capital to help them understand and succeed in science classes. I also discussed how mutual focus among students and solidarity between students and between students and teacher could help our students succeed. The department, as science teachers, could change the relationship between power, knowledge, and discourse (Foucault, 1983) in the classrooms. Michael

Foucault (1983) felt that when power is exercised unilaterally there can be resistance. In cogens power can be shared.

There was some resistance among the faculty in our department to the idea of sharing experiences with students. Many teachers in the department were accustomed to maintaining more traditional control of their classes: Standing at the front, lecturing, and meting out discipline to any student who interrupted. Some teachers were uncomfortable with the idea of students bringing their outside social relationships into the formal structure of the classroom. Other faculty, those teaching the advanced science classes, were most open to the idea of allowing the students in their classes to explore their cultural dispositions. These meetings among the science faculty continued for two years as my research continued. None of the faculty except me implemented cogens in their classrooms, but several faculty members did visit my classroom while cogens were in progress. The students enjoyed talking to the faculty members in the informal atmosphere of the cogen. These conversations were mostly about me as their science teacher. This was understandable as I was a point in common for all. Teacher/student conversations could be shared in ways to help the teaching and learning of science in classes other than my own.

During science department meetings, the instructors also examined the disproportionately low minority enrollment in AP science classes and held a number of discussions about how best to address this. The junior high did not offer AP classes, and I am referring to the district as a whole. The group realized that it had to get other stakeholders involved in order for any change to occur, and this realization led to a broader inquiry into how to encourage others to value diversity in their classrooms. The department members discussed how cogens could encourage more students to become involved in the process of learning.

The group agreed that students might not all have accessed or appropriated the structures or resources available to them. Teachers might not have recognized the ways in which minority students contributed positively to their classes and, in turn, those minority students might have become turned off to these teachers. Department members determined that both students and teachers needed to articulate their needs in the science classroom better.

Most of the members of the science department were female. All were White. After discussions in the meetings, the faculty agreed that it was unfair to see only a few minority faces in high-level science courses. Admission to the advanced classes had been by recommendation and quantitative academic performance requisites. The department agreed that diversity was an important goal to pursue. The faculty decided that the criteria for entrance into those classes needed to change to increase the participation of minority students. The teachers in the science department looked at the criteria being used to decide who would be part of the advanced science classes. They found that there were structural barriers in place that reduced minority enrollment. These barriers were the math score that students needed as an entrance requirement and the way that recommendations were tendered by teachers. Some teachers did not recommend students who they considered might be disruptive. These students could not exercise their agency. The science chairperson agreed to talk to the mathematics department and the administration to see if some changes to the criteria could be made. These were made, and the district was able to increase the number of marginalized students in the advanced classes threefold.

School science can be an alienating experience for low-income urban students like those in my cogen group, and I made it my goal to find a way to overcome and transform those feelings of alienation. In particular, the use of communication patterns in the classroom setting

which are unfamiliar to these students but not to students with middle-class backgrounds can be very discouraging both to students and teachers (Lemke, 1990). Many students have not experienced success in science in earlier grades, and they bring their anxieties and negative experiences with them to the science classrooms and to science laboratory experiments.

The resources of a field such as a science classroom can be accessed and appropriated by participants as they exercise agency to reproduce and transform schema and practices (Tobin, 2006). In order for students to act independently and make their own choices, they must be able to use and produce the resources enabling the entire class to reach higher levels of achievement and a better understanding of the science concepts they will find ahead. These constructs can be considered the culture of science (Tobin, 2006). It is difficult for many students to exercise agency in science classrooms today. Students who know how to act in ways that teachers feel are appropriate in the field of a science class tend to have more success and feel more agency than those who do not. Through cogens I was able to learn what students experience as resources or constraints for their agency in learning science (Tobin, 2006). By utilizing this knowledge, cogens can expand agency and improve opportunities for learning for students and teachers who previously could not communicate across cultural boundaries.

In the sections that follow I will explain how cogenerative dialogue teaching strategies were used to improve teaching and learning in my classroom and how this teaching strategy might be used in other classrooms as well. People experience life based on their memories of past experiences and projections of what is to come and do not experience it merely as it unfolds moment to moment (i.e., only as praxis) Praxis is a form practice of teaching. Given this, all social interactions occur in multiple fields that may be nested, partially overlap, or somewhat independent (Tobin, 2006). My methodology is meant to take into account the

history that—in the present--shapes students' present and future practices. Teaching can be tailored to the cultural capital of students if teachers can identify students' dispositions to act in particular ways and then can figure out what teaching practices resonate with those dispositions. A field is dynamic, and the dynamic structure of a field can lead to a shared cultural fluency in the classroom. Successful interactions can then occur, leading to successful science lessons and successful science teaching and learning.

In this research I looked at the complexity of teacher and student roles, which consist of practices and schema which are enacted with and without conscious awareness (Tobin, 2006). Through cogens students, other stakeholders who chose to participate, and I (the teacher-researcher) created knowledge that prepared students for the 8th grade state science exam as well as for fruitful participation in future high school science classes. There was an increase in the number of marginalized students in the advanced science classes in the junior high school following this research, and these students were able to advance into AP classes at the district high school. Hearing about my cogen groups taught teachers and other stakeholders to use their students' culture in teaching science and helped students use what they learned of their teacher's culture to support their own learning and success.

Outline of the Dissertation Chapters

Chapter 2 is a personal ethnography of my journey toward a career in science education. I myself immigrated to the United States as a small child and learned to speak English in public school. I use my own experience as a lens to examine some of the common challenges facing all immigrant children as well as to reflect on some of the differences between my experiences as a White European immigrant in the mid-20th century and the experience of contemporary immigrants of color. How do the children of immigrants,

especially those on Long Island, balance the demands of their cultures of origin with those of mainstream American culture? I discuss the causes and effects of white flight as I experienced it as a student and later as a teacher in the Bronx and how this led to the decay of schools in the Bronx.

I illustrate how this helped to create the current ethnic and socioeconomic distribution in the part of the Bronx where I grew up, and I discuss my experience as a young teacher in the Bronx in 1969 trying to find my identity as a science teacher in a school that was suffering from the aftermath of the teacher strikes of the late 1960s as well as from a changing school population.

In Chapter 3 I look at racialization and the interaction of gender, education, and the possibility of upward mobility in the lives of students in my cogen group, my classroom, and the school. I discuss how immigration has changed in the past few decades and how these new patterns of immigration affect the children of immigrants today as well as the children who were born in the United States to immigrant parents. I discuss the students in the cogenerative group in my study and the impact of their immigrant or non-immigrant status on their science work, as well as their social relationships in terms of their ethnicities and the importance of understanding immigration and ethnicity and their impact on the science classroom.

Blacks have had an experience around integration very different from any other immigrant groups. I discuss various reasons why this is so. I also focus on the tension that exists between new immigrants, especially those from the West Indies, and American Blacks. I discuss how this plays out in the larger world, my classroom, and my cogen group.

More than a conversation, cogens are discussions among stakeholders based on shared experiences and focused on improving teaching and learning (Roth & Tobin 2001). In Chapter

4 I explain the rules of our cogen and explore how issues were raised and resolved in the cogen. The role of respect is an important aspect of successful cogens, and thus I describe how students and teachers must respect each other. In cogens we learned the importance of the struggle for power that may occur in the classroom and how this is deleterious to the learning process.

I used what I learned in the cogen both to improve teaching and learning in my regular classroom and to understand how those insights might apply to other classrooms as well. I found that cogens grounded in the use of social theory helped lead to a better understanding of the challenges that instructors face when teaching students from varied cultural backgrounds and from ones different from their teacher's. Through interactions in the cogen, the group created resources for building community and for establishing student engagement both emotionally and cognitively.

In this chapter I also discuss how other researchers are using cogens as well as the many benefits that accrue to students when teacher-researchers are in the classroom. Cogens can help students develop a school science identity, build community, and create science engagement.

I used the work of Randall Collins (2004) as a theoretical framework as I sought to understand the interactions in the classroom and the extent to which they become resources for creating a community of learners and contribute to a positive learning environment. In Chapter 5 I discuss what I learned as a teacher and what the students learned from the cogens and in class. Several vignettes are presented. After examining the vignettes, I found that interactions in which positive emotional energy was produced were more likely to show evidence of student engagement such as the focus of eye gazes, entrainment in conversation, and shared action. In

addition, a collective sense of engagement was able to affect other students and bring them into the interaction.

In one of the vignettes, students learned science by playing a game I called the Study Challenge in order to prepare for the New York State required Grade 8 Intermediate-Level Science Test. In this vignette students generated success by creating solidarity and symbols of group membership. In a second vignette students continued to prepare for the Grade 8 Intermediate-Level Science Test by performing the Efferdent/solubility lab. They helped each other as they exhibited synchrony, mutual focus, and solidarity as well as synchronous and asynchronous behaviors.

I found that students enacted culture in multiple fields. The culture that was produced in fields outside of my classroom could be enacted in the classroom without the participant being aware of it. The capital that is produced in one field can be used to attain goals in other fields. I used this idea to help my students expand their agency by using their cultural capital in my class.

In Chapter 6 the vignettes I discuss have to do with helping Beautiful become more comfortable with science by working on a genetics lesson creating Punnett squares. In another vignette Torie has an encounter with a teacher that leads to conflict. Here was a situation where the teacher involved wanted to keep control and viewed Torie as deficient. Later in a cogen we had a conversation about the interaction between Torie and the teacher. This resulted in a conversation about symbolic violence. In this chapter I also discuss how identity can be produced in cogens and enacted in science class. I look at emotions in the teaching and learning of science and discuss agency, solidarity, and passivity. I ask whether through cogens students

would develop the facility to use their cultural capital to maximize positive experiences in class rather than to allow their cultural capital to be viewed as a deficit.

On the micro-, meso-, and macroscopic level, I examine how participants' actions transformed the structures associated with school and the classroom. With the use of cogens a field was created in which stakeholders could talk across the social categories of race, class, age, and classroom roles. Through our interactions in this field, we transformed the classroom into a place where the group had a vested interest in designing and implementing ways to be successful.

Having students meet higher standards and graduate with a Regents diploma demands commitment and resolve as well as an unprecedented investment of time, energy, creativity, and resources at the state and local levels. Schools can change the so-called disadvantaged students' capacities--individually and collectively--in ways that enable those students to experience expanded agency. Rowhena Elmesky (2005) identified and interpreted patterns of coherence and contradictions that occurred in an inner-city chemistry class. She offered a different way of understanding practices that others might have thought of as disrespectful or as acting out. Similarly, I examine the ways that my students acted, which others might have viewed as inappropriate in my own classroom; scrutiny at the micro- and meso- levels revealed that these actions were in fact ways that some students used to gain access to science fluency. I show embodied practices of rhythm, verbal fluency, and high energy and show how those embodied practices can connect these students in empowering ways that expand their capacity for action within the classroom and the school community.

The norms and power structure of White, mainstream culture enable those who are fluent in it to succeed more easily in a typical secondary school science classroom. Therefore,

students who are White, middle to upper class; who have Eurocentric value systems; and who are successful in demonstrating learning in terms of predetermined, standardized assessment measures succeed in the secondary science classroom in greater numbers than do those who are not part of that culture. A good background in science allows access to advanced coursework, higher education opportunities, and careers in science and medicine. Students who are marginalized experience science classrooms where they struggle and have repeated failures. They cannot benefit from a good background in science and the advantages it affords.

In Chapter 7 I discuss my results as well as thoughts on future ways to help marginalized students succeed in science classes. I look at how the production of cultural capital can enhance engagement and learning. This study helps to understand the structure of interactions in a science class by understanding more about the face-to-face encounters associated with organizing, establishing, and maintaining conversations. Achieving parity takes time and effort, but the resulting success is well worth it for students and teachers alike.

I found that in many classrooms students cannot use the culture from their lives out of school as a foundation for learning science. They often feel alienated because they cannot access and appropriate the resources available to them. Many teachers use teaching practices that are not adaptive to the cultural and social capital of their students.

Because fields (like a science class) have weak boundaries and culture belonging to one field can be enacted in others, teachers need to recognize and support students' practices that come from other fields. By recognizing and supporting such practices, teachers can provide students with a foundation for success in science. Cogenerative dialogues can help teachers and students understand the different cultures in the classroom. The cogen helped me to be a better teacher by allowing me to understand what racialization is and how it impacts students as well

as teachers. This understanding can help to dispel negative feelings and positively affect the science classroom. During cogenerative dialogues, students and teachers learn from each other, and both see how students interact with their peers. Although these interactions may at times seem disruptive to teachers, administrators, or other students, they actually may be cultural dispositions that can produce social and symbolic capital and lead to positive interactions in the classroom. Shared goals can be addressed in cogens, and science participation and the understanding of science in the classroom can be improved.

In my Long Island classroom I found that cogens can help bridge the difficulties teachers have understanding cultures other than their own. Administrators and other teachers in the science department as well as teachers who were involved with the students in the cogen were instrumental in helping to discover the importance of cogens in improving classroom learning environments through research. As a result of this research, many more marginalized students are succeeding in science classes in the Suburban School District.

CHAPTER 2

Becoming a Science Teacher

I am an immigrant, and being one has always given me a slightly different perspective on the society around me. Many of the students I have taught have also been immigrants or come from immigrant families. This is the story of one immigrant who came to teach others from backgrounds different from her own but whose experiences in an unfamiliar new world tie them in some common way to their teacher. All immigrants, both children and adults, face the challenge of determining how they will fit into their new society. They need to decide to what extent they will maintain the culture of their place of origin and how they will reconcile that with the new, American, mainstream culture. Sometimes, this can result in conflict between immigrant parents and their children as they clash over how to triangulate between their old and new environments in terms of cultural norms, mores, and self-identification. This, of course, has an effect on the way children from immigrant families approach their schooling. Even though the mainstream culture which existed when I was growing up has fragmented today and no longer provides a single model for my students to follow, as an immigrant, I have nonetheless faced some of these challenges myself.

In 1952 at the age of three, I emigrated from Germany to the United States. I was born in a displaced persons' camp where my parents, both Polish Holocaust survivors, spent five years awaiting entry to the United States. I received my primary and secondary education in the Bronx, New York, and attended college there as well. I majored in science and minored in education at Hunter College in the Bronx, which is now Lehman College. Following my college graduation, I became a science teacher at a junior high school in the Bronx and later at a high school in the same borough. Years later I taught at Suburban Junior High School on Long Island.

In this chapter I will briefly recount my personal history as it relates both to the immigrant experience in contemporary American schools and to some of the challenges the students in my cogen group face. Some of my cogen students are native African Americans. In some ways the African-American experience is analogous to the immigrant one. Their ethnicities and immigrant or non-immigrant status have played an important part in their level of success as students. This chapter also explains my experiences as an outsider--at least to some extent--and how my identity as a science teacher was formed under trying and often exciting times. The experience of being Black in a dominant White culture gives these different groups some common ground, but the different ethnicities and the status of being an immigrant or native born have played an important part in the level of success students from these different backgrounds have achieved.

Early Life in the Bronx

As a teacher-researcher, I have found that I draw on many of the experiences I had in and out of the classroom, many of which relate to my immigrant past. My first language was Yiddish, but as a child I was also surrounded by the many other languages spoken in my house--Polish, Russian, Czech, and German–languages that my parents had picked up as they survived the Holocaust in Europe. It was not until I started kindergarten that I began speaking English. Nonetheless, I was always an excellent student and entered accelerated classes at an early age. As I was an only child, school provided me with most of my social activities. As an immigrant, I faced several challenges trying to fit in. I was not allowed to speak English at home because my parents wanted me to remember my immigrant roots. The problems that I encountered while growing up have helped me to be more empathetic to my students. I have

found through conversations in our cogen that I have experienced much of what first and second-generation students still experience today in adjusting to life in the United States.

Cultures Can Collide

In the mid-1950s to the mid-1960s, I lived in the Crotona Park Section of the Bronx. The apartment building I lived in housed Italians, Irish, Puerto Ricans, and Jews. On the street all children hung out together, playing games, sitting on cars, annoying the grown-ups, or riding bikes. However, when gatherings included adult family members, all the children present were of the same ethnicity and background as the parents. We did have opportunities to understand each other's ethnicities but only on the streets.

Wanting To Fit In

Neighborhoods can lead to the development of increased social networks, subcultures, and groupings that expand capital (Pitts, 2007). Evelyn Gonzalez (2004) argues that Bronx residents created social areas that were composed of a street, a social block, and a neighborhood where residents socialized with family members and friends. The social networks that were created allowed new immigrants like myself to learn how to become part of mainstream society. I remember wanting very much to fit in with other children. Although my best friends were from families similar to mine (from Europe), I remember wanting approval from children of other backgrounds as well. I remember Chickie, whose family was from Puerto Rico but who had been born in the United States himself, making fun of my family's green ways. Among ourselves, the immigrants, we called ourselves *greeners*, meaning we were new. We were learning the new culture in the United States, but we were still clinging to the culture of the old country. Even being born here did not preclude misunderstanding when your parents are immigrants. When I tried to dress the way Chickie recommended, my parents were

appalled. No big gold jewelry for me. Chickie didn't understand the culture any more than I did. Although the parents of children like me had made the move to America, they were reluctant to let us explore the many cultures America had to offer us, because they did not understand them yet.

I came to America when I was three years old, therefore, I never spoke with an accent. I was White, so I was indistinguishable from the predominant groups of people in the neighborhood who were also White. As I grew older, I learned not to wear the immigrant-type clothes my mother picked out for me. In kindergarten and in the early elementary school years, I didn't feel comfortable with the mainstream, although I wanted to be part of it. As my attire became more up-to-date, I was more comfortable with my American peers. My parents, however, still wanted me to keep my immigrant roots. In class I fully embraced being an American. At home, I fully embraced being an immigrant. Even today I still only speak *mamaloshen*, Yiddish, with my mother. On the outside I appear totally American; on the inside I am still an immigrant. This experience has relevance as it helped me to become a teacher who understands her immigrant-family students

At the time I was acculturating, many people arriving in America left behind their old cultures and mixed together. They looked to join the American mainstream culture which may have had little in common with the country from which they immigrated. Immigrants understood that some assimilation was necessary in order to gain resources such as jobs, schooling, and improved social status, but there were often struggles among immigrant parents and children as to the best way to maintain culture from the country from which they came while embracing mainstream American culture. As I mentioned previously, I experienced this need for balance with my parents. I see similarities with my current students. My Dominican

student, Krystal, told the cogen that she had to be home after school everyday to help take care of her younger siblings. She also mentioned that her mother did not want her to stay at school because she didn't want her to have too many friends who were different that her. As I had, Krystal, too, needed to find a balance. The cogen helped her to do this because in the cogen she was able to be with others who were different than she was.

During the 1950s as I was growing up in the Bronx, school did not prepare us very well to embrace different ethnicities. The point was to Americanize everyone. In our school at that time, there were very few Black children, perhaps 10 in a school of 1,000. If we interacted with them at all, it was only in school. We never played together in the streets. These Black children lived only a few blocks away from us but lived in a *different* neighborhood and within a *different* culture. There was, as I've noted above, very little interaction between neighborhoods. This was during the period when a great internal migration was taking place. African Americans were moving from southern to northern cities, and Puerto Ricans were moving from Puerto Rico to the U.S. Most of this migration occurred from 1930 to 1965. The migration of Puerto Ricans was precipitated by economic distress in Puerto Rico. Nearly 100,000 Puerto Ricans settled in New York City by the 1950s (Franklin & Moss, 1994). Many eventually moved to the Bronx where rent was more affordable. The neighborhoods were changing, but as a child I was not aware of it.

My Early Education in the Bronx and Citizenship

In the elementary school I attended, I remember there being only one Black boy and one Black girl in my class, which had about 30 students. I don't remember any Puerto Rican students there at all, although there were some in my neighborhood. From kindergarten to 6th grade, we were tracked according to reading level, and most students, including those in my

class, stayed together for many years. Our progress from grade to grade together defined the boundaries of our social as well as our academic lives. The school was in a big building with seven grades (K-6). I remember lining up on the first floor of the building by class and the teachers coming to get us to bring us to our classrooms. We left the building in the same way. We all lined up on the first floor of the building at the end of the day and were dismissed from there by our teachers. On Wednesdays we had assemblies and had to wear red, white, and blue. We felt that we were important to our school and community.

In the school district on Long Island where I taught, the schools went from K-4, the middle school from 5-6, the junior high school from 7-8, and the high school from 9-12. The school district has many activities that help students feel important to the community as well as the school, but not all students are able to access these services to the same extent. Just as in academics, marginalized students often are not able to access the structures that are available to them. Of the students in the cogen, only Torie took advantage of the sports program. The others did not participate in sports or in activities that involved them in the community outside of school.

In the 4th grade I became an American citizen. I still remember the ceremony in Manhattan, saying the Pledge of Allegiance, and the certificate that I was issued saying that I was now an American citizen. At the ceremony the judge called all the children onto the auditorium platform. When I looked around, we were all shades, shapes, and sizes, all with smiles. I didn't talk about it with my schoolmates. My friends at school were all born in the United States and were automatically citizens. Their parents were immigrants, or their grandparents, but they were not. I didn't want to call attention to my situation. The experience remains in my memory for another reason. At that time, although I gained my citizenship, my

mother did not. My father had become a citizen the year before me. My mother was afraid to take the literacy tests required to become a citizen. At the age of 90, my mother finally became a citizen. We went together on a day that was set aside for senior citizens at the Federal Courthouse in Manhattan. As I looked around at the people gathered there, I saw a panorama of cultures similar to the one that I remembered from so many decades before, but many of the people were in wheelchairs or on walkers. My mother, as did all the other potential citizens, had to pass the same literacy test she had been afraid of so many years ago. It was very crowded, and there were a lot of anxious faces. She passed with difficulty. My mother did not go to a citizenship ceremony but a few months later a certificate of citizenship was sent to her. I was as proud of her as I was of myself that day so many decades ago.

There is a connection between my mother's experience becoming a citizen and that of my students' parents. My mother was afraid to navigate the bureaucracy just as immigrant parents are today when it comes to navigating the school system's bureaucracy. These immigrant parents usually do not come in to speak to teachers or administrators, and, if they do, their children serve as their interpreters. Sometimes parents and children are embarrassed by this.

Housing Patterns Change the Bronx

The early 1960s were a pivotal time of change in the Bronx. I lived in the South Bronx when Co-Op City opened in the northern Bronx, near suburban Westchester County. In a few short years the racial and economic composition of public schools in the Bronx changed drastically. As African Americans and Puerto Ricans moved into the Bronx, White residents who could afford to move did. They moved to suburban areas such as White Plains and Long Island and to northern sections of the Bronx like Riverdale and Pelham parkway. I moved to Pelham Parkway in 1962.

The Bronx Was Burning

In *The Bronx* Evelyn Gonzalez describes how the deterioration of the Bronx began. The Mitchell-Lama law in 1955 provided low-cost mortgages and tax incentives to developers to build middle-income housing. This was meant to help families earning less than $10,000 a year who could not afford an apartment in the city. From 1955 on, the state subsidized housing for the middle class. Many of these people felt threatened by racial change and the slums that were spreading. However well-intentioned Mitchell-Lama housing was a disaster for the Bronx. The co-ops that were built siphoned off White families from housing that was still in good shape. This left vacancies that were filled by poorer Blacks and Puerto Ricans who themselves were displaced or moving away from slums that were even worse. Gonzales states that the best example of this was Co-Op City, which was built during the late 1960's. Its 35 buildings with 15,500 apartments encouraged many White Jewish residents to abandon the Grand Concourse neighborhood almost overnight. The Grand Concourse area was where I would begin my teaching career. As more minorities came into the neighborhoods, more Whites moved away. Every mugging, whether rumored or true, became an incentive to leave. I can attest to this. It was the reason why my parents chose to move to the North Bronx at that time. We could not afford Co-Op City, so we moved into a public housing project that was mostly White in the Pelham Parkway section of the North Bronx. The Cross-Bronx Expressway also created problems for neighborhoods in the Bronx. It sliced through neighborhoods and destroyed blocks of apartment buildings. Public housing, urban renewal, and highways helped to create slums. Housing created under Mitchell-Lama increased the separation of the White middle class from those who were poorer and disadvantaged. There already had been some economic segregation, but when I was growing up all the ethnicities living together. Even though we didn't have much contact with each other, we were all of similar economic means.

In addition, landlords and tenants abandoned, vandalized, and burned apartment buildings that had been fully occupied a few years before. The apartment buildings on the Grand Concourse itself were too good to abandon, and the residents there went from being mostly White and Jewish to mostly African American. The streets radiating from the Grand Concourse, however, were narrow and had closely-packed, large apartment buildings with few trees. On these streets there was abandonment and arson. Making the arson more possible were the installation of a less reliable fire alarm system and the shuttering of firehouses in places where they were most needed. A delayed fire response meant that fires increased in number and severity (Gonzalez, 2004). These were the streets that sent students to Taft High School, the school where I would find myself teaching in 1969.

Previously, Bronx apartment buildings provided homes for families and profits for landlords. Now, however, Bronx landlords had apartment buildings with no tenants. Tenants were sleeping in their clothes with their shoes on, because there was so much arson. I spoke recently to a retired fireman friend who was working as a fireman in the Bronx at that time. He said that people could be seen walking through the streets with their belongings after a fire had forced them out of their building. In addition, some landlords cut down on maintenance, rented to undesirable tenants, collected whatever rents they could, and left.

The insurance companies never even investigated those fires. They just paid out the claims and passed the expense on to everyone else in the form of higher premiums. Living conditions for many tenants in Bronx apartments became squalid. Many of the newcomers were poorer and less educated than former residents, and newly-arrived Puerto Ricans often spoke little or no English. There was frustration and a feeling of helplessness among the new residents and the teachers in the affected communities (Urban and Unger, 2006). Local

businesses and stores went out of business or moved elsewhere. Heroin moved in and became the friend of too many.

Junior High Portends the Future of Education in the Bronx

I felt all of this on a personal level, as this change was occurring as I entered junior high school. For junior high school I was accepted into an accelerated class at Herman Ridder Junior High School. I traveled on two buses to get there. This was at about the time that the Bronx began to change because of White flight. Those who had reached the middle class began moving out of Crotona Park. During junior high, my classes were mostly White, while the rest of the school was Black or Puerto Rican. All the White kids stayed together. We never met the kids from the neighborhood who were Black and Puerto Rican. I don't remember even talking to one student from these ethnic groups. We traveled in bunches through the halls, keeping together. It is interesting to note that when we walked together in bunches, it was accepted, but today at Suburban Junior High the faculty is very uncomfortable with this practice.

When I was in the accelerated track in junior high school, I experienced what would later happen to most of the South Bronx, where schools came to be made up mostly of Black and Puerto Rican students. White immigrant children of an earlier period, both first-generation and second-generation, had benefited from the opportunities that schools had provided, but Black and Puerto Rican students came into schools at a time when there was great turmoil in the society as well as in education. In addition, veteran teachers in schools were unprepared to deal with the new minority students. I remember that in junior high our teachers told us how grateful they were to have us as students. We reminded them of the way school had been before the White flight.

A Special High School Experience

I attended the Bronx High School of Science. Then, as they do today, students came from all the boroughs to attend this specialized school and similar ones in the city system. Entrance was and still is by exam. I attended Bronx Science because it was the only special school for which I qualified. When I went there, there was a quota for females. Only one-third of a class was allowed to be female. Today more than half of the student population is female. At the time I went to Bronx Science, it was mainly White. Today, the school's demographics reflect the diversity of New York City as a whole, with dozens of ethnicities represented among its more than 2600 students. Bronx Science was a place where students and faculty alike experienced the excitement of the motivated mind with a common goal of advancing the self and society. I got a wonderful education there. I wish that others could have exposure to the same opportunities.

After high school, I continued my education at Hunter College, where I graduated with a degree in biology and a teaching certificate. I chose a career in teaching because I wanted to help others. I chose a career in science education because I had accumulated so much knowledge at Bronx Science that I wanted to share.

The New York City Teachers' Strikes

After college I started teaching at a time that coincided with the end of the 1968 teachers' strikes. I was 20-years-old, female, White, and Jewish. The United Federation of Teachers (UFT), the nation's largest union local, led a fourteen-day strike in 1967 and a thirty-six-day series of strikes in 1968 which closed down the nation's largest public school system and threw the lives of one million students and their parents into chaos.

The precipitating event that had started the longest strike in 1968 was the introduction of community control of local schools. A local school board in the mostly Black Brownsville

section of Brooklyn began firing its mostly White, Jewish teaching staff. These firings prompted the United Federation of Teachers' strike. Both incidents stirred up racial animosity, particularly between Black parents and Jewish teachers. Members of the union were called racist for opposing the black community's quest for greater self-determination and control over the schools. Behind the decentralization effort was a desire to give minority communities a greater voice in the school system. The strike brought to a halt to the city's attempt to decentralize the school system. Union contract protections against arbitrary dismissal were preserved; the teachers returned, and the threat of community control diminished.

The Ocean Hill-Brownsville strikes of 1968 left an indelible mark on New York City. The strike ended and students returned to school, but the issues raised by the strike--bigotry and the future of community control--remained to be sorted out. I was supposed to start teaching in September of 1968 but refused to cross picket lines to do so. When I talked to teachers at Taft High School after I started teaching there, they were haunted by comments they had heard hurled at them during the strikes. Teachers told me that they were called "white racist pigs", were asked "who's going to protect you when the police leave?", and heard "you are the enemy of the people".

I started teaching in early1969 after the strikes, but I was supposed to begin September 1968. I did not want to cross the picket lines, so I worked as a laboratory technician at New York University Medical Center until the strikes ended. The United Federation of Teachers comprised 55,000 of the city's 57,000 teachers. The union had wanted to close the schools down completely during the strike, but about 350,000 students were able to attend classes, either in schools that remained open with substitutes and teachers who crossed picket lines or in makeshift classrooms set up by parent initiatives (Kahlenberg, 2007). The strike was illegal

under laws at that time, and Albert Shanker, the head of the U.F.T. served a jail term for sanctioning the strike. More than 7,500 union members violated union orders by teaching outside of the union-authorized schools (Kahlenberg, 2007). In many areas parents physically occupied their schools to make sure they stayed open (Kahlenberg, 2007).

How the Strike was Relevant to my Subsequent Teaching Experience

The teachers who found themselves caught up in the strike fell on two sides of the issue. The strikes made apparent a difficult divide that had no easy or safe middle ground. On one side were teachers who justly denounced the education taking place in many inner city schools in New York, which they felt programmed poor children for a life of adult poverty. On the other side members of one of the most progressive labor organizations in America, the United Federation of Teachers, felt it necessary to assert principles of academic freedom and due process when professionals were dismissed from their posts. This was no simple conflict of right or wrong, but a fight between two rights. No matter which side the teachers involved took, they were educators who passionately believed that they were in the right.

I finally took my place as a teacher at W. H. Taft High School in the Bronx in the immediate aftermath of the strikes, and they had a huge impact on the formation of my identity as a science teacher. I realized very quickly that I would have to choose carefully which teachers with whom to align myself, as incredible acrimony between those teachers who had crossed picket lines and those who had participated in the strikes lingered after the strike. Because I had postponed teaching until the strikes were over, I chose sides with those who didn't cross the picket lines, but I tried to be friendly and professional with all. The wounds never healed while I was at Taft. Colleagues who had previously been friends for decades

could no longer tolerate each others' presence, and people on both sides tried to influence new teachers by denouncing their former friends.

New York City was racially polarized (Kahlenberg. 2007). During the strike many students were not being educated, but many students who attended school after the strikes were not receiving a useful education. The parent-teacher relationship had been transformed from one that seemed to represent an alliance between parents and teachers to one of bitter antagonism. After the strike inadequate schools were still the same inadequate schools, and hostility between Blacks and Whites and between parents and teachers were evident. When the strike was over, ideally those who were on different sides of the immediate issue but who shared common values and concerns should have once more come together. Without that reconciliation the only victors of the situation would be backlash and poverty. Unfortunately, when I started teaching at Taft in February of 1969 (three months after the strike had ended), I mainly experienced anger, backlash, and poverty. The only glimmer of hope was that out of the chaos some opportunities had developed for new teachers to expand their agency, utilize structures, and establish their own identities as science teachers by trying, inventing, and implementing a new curriculum. I discuss some of these curriculum ideas that helped students and teachers change structures and gain agency later in this chapter.

My First Day at Taft and Beyond

My first day as a science teacher at Taft was not what I had expected. I had done my student teaching at my alma mater, Bronx Science, so I was prepared to deal with science questions, not questions of discipline. I had had no orientation because I started mid-year. My first-period class on the first day of school had 40 students, and there were not enough seats. After students filled the available seats, others sat on the heaters. During my first break I went

into the department office. There the science chairman mainly advised me to lock my door while I was teaching, as outsiders--mostly drug dealers looking to make sales--were often in the building. The rest of my classes that day were equally crowded, and I remember leaving school seriously considering not returning. Of course, I did return the next day and for four years after that. Things did not necessarily get any better, however. Violence on the streets created by the change in the local neighborhoods had spilled into the schools, as had an epidemic of drugs. Outside, the streets were in chaos. Chaos manifested itself in our school as well. We had no guards, and other teachers as well as the department chairman advised me not to send students to the bathroom, because opening my door would expose me and my students to possible intruders.

By talking to other new teachers, however, I realized that we could help ourselves and our students by helping each other. We were in the halls between classes and also when we weren't teaching because the school hoped that the teachers' presence would reduce the likelihood of intruders approaching students. We volunteered to spend time with the students in the lunchroom as well. This help was meager, but it was all we thought of at the time.

Veteran teachers at Taft bemoaned how good the school had been and how the new students (Blacks and Puerto Ricans) had spoiled it. According to the teachers with whom I spoke, this school had been one of the top schools in the Bronx. Discipline had never been a problem, and the veteran teachers just wrung their hands in despair as they saw themselves losing control of the students. Although these veteran teachers had excellent reputations and thought of themselves as excellent teachers, they did not have success in this new environment. I still remember to this day how disillusioned I felt as I listened to the veterans as I was trying

to form my own identity as a science teacher. They were, unfortunately, part of the problem, not part of a solution.

In his dissertation, which discusses formation and transformation, Wesley Pitts (2007) suggests that these experienced teachers may have felt that their core identities as science teachers were being challenged when they were asked to find alternative ways to teach this new population of students effectively. This, Pitt notes, might have elicited a culture of resistance. From my observation, I feel that this may well have been true. Pitts (2007) goes further and quotes Richard Valencia (1997, p.8), "many adults who develop educational policies for students attribute school failure to students, and school success to themselves."

The Culture of Activism Nurtured My Own Will to Change My Teaching Practices

As neighborhoods changed, so did the composition of the schools. Veteran teachers in these schools were unprepared to deal with the new students. It would take several years and a new crop of teachers even to begin to facilitate change. Taft High School became a reflection of its neighborhood. It had been a school of mostly White students and White teachers and became a school of White teachers instructing a student body composed of mostly Puerto Ricans and African Americans. This happened within a span of a few years in the late 60s and early 70s. As Co-Op City was being occupied by owners, I began teaching in a school that also pitted culture against culture (that of White middle class teachers against that of African American and Puerto Rican students).

In the fall of 1969, a new crop of activists entered the New York City school system as teachers. The Vietnam War had increased the number of males—particularly White men--entering the teaching work force in the Bronx. These activists were mainly young men seeking a way out of the draft–one way to be released from service in Vietnam was to serve as a teacher

in a disadvantaged, underserved urban area (Fosburgh, 1969). Many of the men who came to these urban schools were liberal-minded, did not have roots in or prior allegiances to New York, and wanted to make a difference. Black men were less likely to take advantage of this option because on average they were less able to pay for college (a key requirement to becoming a teacher). Many of the White males who took this option were from the Midwest and ended up teaching in rural and urban communities of color. One of the most pressing problems these activist teachers tried to address was how to reach out to Black students, whom the school system had been failing in disproportionate numbers.

The new teachers were excited to be there and hoped to make changes in the culture of the school. By talking to other new teachers, however, I realized that we could help ourselves and our students by helping each other. We were already in the halls between classes and also when we weren't teaching, and we volunteered to spend time with the students in the lunchroom as well. This help was meager, but it was all we thought of at the time.

Here in this school that was changing we saw an opportunity to create a community at the same time that we forged identities as science teachers. We wanted to create new structures within the school, and we tried to form social networks with other new teachers with similar ideas. We had some opportunities, because the veteran teachers (who in an ideal world should have been helping us) just wanted to be left alone. They were out the door when the bell rang at the end of the day.

New Curriculum Is Invited

Because of the declining academic performance in the school, teachers and administrators were open to any projects that might bring some change. I got a National Science Foundation grant the first summer I was at Taft to attend a two-week seminar at

Stanford University on new ways to teach science to disadvantaged students. After my difficult first year the summer at Stanford reinvigorated me and taught me many things that I have subsequently used in my classroom. First and foremost, one of the lecturers at that Stanford teaching seminar, Harry K. Wong, expressed the firm belief that all children could learn and that a teacher's job is to get them interested. He demonstrated some novel hands-on experiments at which students could not fail. I returned with *Ideas and Investigations in Science* (Wong, 1971), which made fruitful use of these sorts of labs to teach science. My students loved cooperative learning, and I tried to encourage others in my school to pursue the program. With the support of my chairperson, soon the whole department was following this hands-on-teaching science program in the non-Regents classes.

Another way that the new teachers tried to make a difference was by adding to the curriculum. The principal at Taft also allowed another teacher and me to develop and teach a psychology class for seniors. We planned to cover college-level psychology material, trusting that the inherent interest and novelty of the topic as well as our rapport with the students would enable the class to be a success. James Gee (2004) could easily have been talking directly to the Taft High School staff of 1969 when he asked,

> What is it about school that manages to transform children who are good at learning --- regardless of their economic and cultural differences, into children who are not good at learning, if they are poor or members of certain minority groups? (p. 10).

It was widely assumed by the administration and other faculty that our psychology class would be a failure. How could our students possibly read college-level articles in the field of psychology? However, our students proved them wrong, engaging with and mastering the material. The class, an elective with prerequisites and grade-point-average requirements, ran for many years as a permanent part of the Taft curriculum and was always oversubscribed. Students came back year after year to tell us how meaningful the experience had been for them.

The students, who were Black and Hispanic, were able to achieve the grade prerequisites in part because they were motivated to join the psychology class. The students saw this as an opportunity to learn in a distraction-free environment. When the opportunity presented itself, they took it and learned.

It was a turbulent time for the Bronx and for its schools. Teachers were unprepared for the changes that were taking place each day. The district where I worked in those years still remains one of the poorest in New York City. Although I left teaching in the Bronx in 1973, I kept in touch with my faculty colleagues for many years. Teachers who had been present during the White flight—the exodus of many White families from places where people of color were moving in--changed schools or retired. The school I had attended was turned into several mini-schools which, unfortunately, to this day still rank low in the academic standings of the New York City school system.

The Importance of the Teacher-Student Alliance

Producing and sustaining solidarity involves continuous effort, not just from the designated leaders but from the collective (Turner, 2002). When I was at Taft, I formed alliances with the Black female students, but I never learned their culture, nor did they learn about mine. At that time we were close in age; I was in my early twenties and they were in their late teens. I met some of the students at museums in New York City. We arrived separately, met at an agreed upon place, and I talked as we walked together. Then we went our separate ways.

The culture of urban neighborhoods is often not recognized by teachers who have lived their lives in different types of neighborhoods. The students' cultural capital may be viewed from a deficit perspective. Teachers may want to extinguish the urban culture because they

believe that this culture may prevent students from learning science. At that time I felt that way, too. It wasn't until 30 years later when I began using cogenerative dialogues that I realized that there are better ways to understand my students and to help them understand me. At Taft I started to understand that the only way for students to do science was to do what was familiar to them in their outside lives. They needed to be able to use their cultural capital to produce science culture. They could learn only if structures were in place that allowed them to learn. As a teacher, I needed to provide them with those structures and to be adaptive. I needed to teach in ways that were appropriate to the students in the classroom. To be an effective teacher I needed my students to "have my back", and I needed to have theirs. (Using cogenerative dialogues years later, I was able to give back and "have their backs".)

At Taft during laboratory experiments, I spent a few minutes talking about students' home life as we worked on science experiments and I walked around the room looking at the students, offering encouragement or asking questions about the experiment. I would overhear comments they were making to each other and would respond if it sounded as if I knew something about what they were discussing. For example, if I heard them talking about a rock and roll song I recognized, I would say I knew the song as well. This led to discussions about the kind of songs I liked and the kind of songs they liked.

The Taft students participated in setting the curriculum for my elective courses, and they were very active during hands-on experiments. Looking for possible ways to improve science learning for my students helped form my identity as a science teacher. I realized that laboratory activities offered an excellent way for the goals of the individual and the collective to be achieved. I would continue to focus on laboratory experiments as a way to transform science education for marginalized students.

I did collaborative work and had conversations with students that anticipated the work I did on the research that is the subject of this dissertation. I was using some of the elements of cogens at Taft. This sort of collaboration between teacher and student is central to my research and to cogens.

The War on Poverty Leads to a Deficit Perspective

Responding to a racially and economically divided country in the 1960s, President Lyndon Johnson called for a national War on Poverty. Johnson believed that the poor would lift themselves out of poverty by acquiring the skills demanded by a complex society. He called this the Great Society. One of the places where the Great Society would be built would be in the classrooms of the United States. As a result of the Federal effort, Taft created an annex for college-bound students in 1970. The annex housed students who had maintained grades that would qualify them for college admissions and students who were interested in improving their grades. It had its own set of teachers, so it was similar to what is now termed a *mini-school*. It lasted a few years, but the budget crisis that affected New York City in the early 1970s brought about its demise.

For all its good intentions the Great Society also led to pedagogical practices across the United States firmly rooted in a discourse of cultural deprivation (Ladson-Billings, 1999). This perspective explained the "disproportionate academic problems among low-status students as largely being due to pathologies or deficits in their sociocultural background" (Valencia, 1986, p. 3). At Taft those teachers who were interested in helping these marginalized students bought into this argument. These deficit-framed pedagogical practices have proven unsuccessful. I have found in my teaching experience that students who don't conform to the dominant culture are often seen as in need of "fixing", and teachers may try to replace behaviors that are not mainstream with others that are. Until I began this research, I often tried to alter student

behaviors. I recommended ways for them to enter the class quietly, talk quietly, and look me in the eye. After having conducted my research, I now realize I was trying to have them behave according to the rules of the dominant culture.

My Career on Long Island Begins

After I left Taft in 1973, I lived in San Francisco for a year and then in the Philadelphia area for 5 years. While in Pennsylvania I taught science at a high school in Ambler, Pennsylvania. Following that, I lived for 2 years in Burlington, Vermont, where I did not teach because the salary for a teacher there was less than what I would have had to pay the babysitter. I returned to the New York area in 1981, seeking to teach once again. I had to recertify in Earth Science because I could not find a job with biology and general science certifications. I was a substitute teacher, and I did leave-replacements until I obtained a position with Suburban School District on Long Island as an earth science teacher in 1992. The district had a reputation for hiring teachers with experience in the New York City schools because its student body had demographics similar to those of disadvantaged areas in New York. It was a good fit.

In 2002 I began the PhD program at CUNY Graduate Center. When looking for a topic for my dissertation I decided to do research on my school on Long Island because Long Island continues to become more racially and culturally diverse. In Suburban School District as well as in others on Long Island, rapid immigration is clearly the predominant cause of this increasing diversity. Since 1990 the Whites have declined from 84% to 72% of the population, and since 2005 the percentages of the population identifying themselves as Black, Hispanic, or Asian has edged up slightly. Hispanics are both the largest and the most rapidly growing minority group, having increased from 6% to nearly 13% since 1990. The Black population increased modestly, growing from 7% to 9% (Long Island Index, 2005), but fully one-quarter of the Black residents of Long Island were born overseas (Long Island Index, 2005). This

mirrors both national and regional trends in terms of the general movement toward greater diversity.

Thirty-five percent of the students got free breakfast in our district at that time, and I had noticed as I stood outside my classroom that many of the students getting free breakfasts were Black. They passed by my room as I monitored the hallway in the morning before school began. I also noticed that teachers who monitored the halls constantly argued with and reprimanded those students as they passed on their way to the cafeteria. The teachers expected students to pass through the halls talking quietly to each other. Some students did pass through the halls quietly. These were mostly the White, Asian, and Hispanic students. The Black students talked animatedly and often called out to each other across the hallways. The students were loud and did travel in groups. The other teachers in this hallway were White, as am I, whereas most or all of the students passing were Black. Some teachers had a confrontational stance towards those students, and many times confrontations did occur. Female students were just as ready as the male students to enter a confrontation with a teacher or with each other. I also witnessed that Black students tended to walk in groups and to stay together as a group. Later in this dissertation I discuss an incident that occurred in the hallway involving one of the students in my cogen and a teacher in the hallway in front of his room during the time students were passing from one class to another. After this incident the student was very affected and did not want to begin her next class. I feel that if a teacher reprimands a student before she enters the classroom, even if the teacher were not the student's instructor, the student will be less willing to engage in the classroom. This type of incident was common in my school

I am Evaluated at School

In 2006 during my yearly observation, I received an unsatisfactory rating for class control, because I did not shut down student behaviors like walking around the classroom, interacting socially with peers, and rhythmically tapping on desks. These are similar to the practices that Elmesky reported in 2003 which were often shut down by teachers. My intuition and experience had led me to the same conclusions that Elmesky reached. The principal summoned me to a meeting and asked me to explain why these practices were not evidence of poor class control. I did not show Elmesky's work, but I pointed out that avoiding shutdowns was a key component of the teaching methodology my research was examining. Pervasive shutdowns, I noted, suppressed important components of the cultural capital of my students, leading to negative emotions, frustration, and ultimately low interest in science on their parts.

Even after that meeting and with the administration ostensibly expressing support for my research goals and methodologies, administrators watched me closely for several weeks thereafter. Had I not been a tenured teacher with an otherwise unblemished record, I might have been forced by intimidation from school administrators to discontinue my methodology. As it was, I experienced direct interference from administrators on multiple occasions. My chairperson taught in my classroom immediately after my research class concluded each day, and although she expressed support for my work and diversity issues, she often entered my classroom while my class was still in session and took it upon herself to discipline my students during my class. Although the students she disciplined at this time were Black, I believe that she disciplined students who were enacting cultural norms which she interpreted as disrespectful because she did not share their culture.

Rather than undermining me, this lack of administrative support made it even more important for me to disseminate my findings to other science educators.

My Teaching Methods Change

Teachers today in science classes across the country are still unprepared when it comes to teaching minority students. They still teach from a deficit perspective rather than by engaging with the cultures of their students. Shutdown strategies are still all too common in science classrooms, and, misunderstanding their students, veteran teachers as well as new teachers wring their hands and think that students are choosing to fail their classes. The use of cogens played an important part in my pedagogy and ultimately resulted in improved science learning in my classroom.

The students in my classroom came from a diverse range of ethnic, racial, and socioeconomic backgrounds. My classroom provided a structure for whole-class interactions and offered opportunities for inclusion of all members of the class. Students who participated in conversations acquired more energy and self-confidence and became fully engaged in class lessons. I hoped to find that students in my cogen group were successful in my science class and advanced to AP science classes at the local high school, and this did turn out to be the case. I looked to see if solidarity contributed to a positive learning environment. I have found that solidarity emerges gradually and involves the exchange of social capital, cultural capital, and respect, a form of symbolic capital. Goals in cogenerative dialogue create solidarity grounded with a respect for difference and willingness to learn from others. Cogens became a tool to build community in my science class. Students accomplished their own goals as well as the goals of the collective. As a teacher-researcher, I found ways that cogens helped to create student engagement. There was evidence of a shared mood and entrainment as the individuals in the group synchronized their practices and shared the resources they needed to progress with

the lesson. A community of learners formed and contributed to a positive learning environment.

I found that talk was a way to measure solidarity in the classroom. Ordinary talk is at the heart of how people make social reality seem real. Individuals communicate emotions by prosodic and other observable means. Emotions and talk are the glue that binds individuals in a group together. As a teacher-researcher, I was able to examine the talk in my cogens and in my classroom. I observed alignment and synchrony. I looked for rhythmic patterns of gestures, rocking movements of legs or heads, and stressed syllables that were produced and reproduced in synchrony by members across the classroom. Because the conversations and actions associated with a science lesson were important to me as a teacher-researcher, I used primary data from the videotapes of classroom interactions to produce the transcripts that I then analyzed. When my students communicated in conversation they varied their speaking to communicate subtle cues like energy by being loud, or spontaneity in their expressions. These cues are open to interpretation. Video and audiotapes allowed me to understand the cues accurately (often replaying the tapes over and over to get my interpretation right).

As a teacher-researcher, I sought to make sense out of my students' ongoing process of making sense of their world. This helped to explain what a student felt about the conversation he or she was having. A collective sense of engagement affected other students and brought them into the interaction. Students involved in the interaction enjoyed their experience in the classroom and, I hope, will continue their interest in science. I strove to understand the structure of the interactions in my science class by understanding more about the face-to-face transactions associated with organizing, establishing, and maintaining conversations.

The evidence that I collected provided opportunities to examine carefully aspects of my lessons and led me to a greater appreciation for the impact of lessons on the range of classroom contexts, including entrainment and solidarity. The patterns I observed during a ramp-and-ball laboratory experiment as well as during cogens formed a basis for changing some of the teaching and learning structures in my classroom. It led me to propose several potential ways that science teachers could use students' prior experience of science to further their scientific interest. I believe that these patterns demonstrate how student engagement and the building of solidarity in a science classroom could generate agency among students which could greatly improve students' interests and abilities to continue their science education.

As an immigrant, I have seen that my perspective of the society around me has an effect on the way my students, children from immigrant families, approach their schooling. Ethnicity is a complex and changing notion, one that I have dealt with throughout my teaching career. My current students come from diverse cultures. In the next chapter I explain how their ethnicities, complex and dynamic, and their varied experiences in school helped forge their identities.

Chapter 3

Immigration, Race, Ethnicity, and Gender in a Junior High School Science Class

Children of Immigrants

In this chapter I examine racialization and how gender, education, and the possibility of upward mobility interacted with the lives of students in my cogen group, my classroom, and the school as a whole. I provide more detailed information about the makeup of the cogen, how it was structured, and the methodology I used in implementing the cogen in the next few chapters of this dissertation.

Mary Waters (2008) defines second-generation immigrants as those born in the United States to at least one immigrant parent, while the 1.5 generation as people born abroad who arrived by age 12 and subsequently grew up in the United States. The contemporary second-generation and 1.5-generation children who are now coming of age must negotiate new and different ways of being American than their predecessors did. They are creating a new kind of multiculturalism, a type of hybridization where fluid exchanges can occur among the boundaries that groups set up (Waters, 2008). I found that in my research cogenerative dialogues helped students understand each other's culture by holding conversations in which they shared their thoughts about community, family life, and their vision for success in school. Cogenerative dialogues can help cultural changes take place in classrooms across America. It served as a tool to examine the interplay of immigrant cultures with the dominant American culture, as seen in the interactions between first-generation, 1.5-generation, second-generation groups, and native-born minorities. In my classroom I was able to examine the interactions between second-generation and native-born minorities.

We are in the Midst of the Largest Wave of Immigration in History.

Before 1965 immigrants to the United States were overwhelmingly European, while most immigrants since then have come from other parts of the globe. In the first wave of migration up to the mid-19th century, northwestern Europeans immigrated to the U.S. In the second wave southern and eastern Europeans arrived at the end of the 19th and beginning of the 20th centuries. In the third wave, Mexicans and Puerto Ricans came in. In the fourth wave since 1965, immigrants mainly from Asia and other Latin Americans have entered the country (Pedraza, 2006). Each wave of immigration was characterized by a different racial and ethnic composition and coincided with profound changes in the nature of American society. The African American internal migratory movement largely between the two World Wars and after World War II was a significant but different movement.

In *Inheriting the City* (2008) Mary Waters reports that today's immigrants make up 10% of the U.S. population and that their U.S.-born children account for nearly another 10%. In New York more than half of the population is now of immigrant stock (Waters, 2008), and nearly two-thirds of New Yorkers under the age of 18 have immigrant parents (Waters, 2008). The March 2005 Current Population Survey (CPS) reported that nationwide in this new second generation, the children of at least one immigrant parent born in the United States or who arrived by the age of 12, accounted for one out of six 18- to 32-year-olds in the nation, and one out of four of all Americans under 18. In two generations, nearly half the population will be the children and grandchildren of today's immigrants.

Now that the country is in the midst of the largest wave of immigration in history (Foner, 2005) with the vast majority of these immigrants coming from Asia, the Caribbean, and Central and Latin America (Foner, 2005), the United States once again faces a future in which

new arrivals will shape the character of the nation. At the center of this prospect are the children of immigrants.

Both the African Americans who can be viewed as a group that immigrated into Northern culture and the African and Caribbean Blacks have had, as immigrant groups, a very different experience around integration than any other immigrant groups. The experience of Black immigrants to the U.S. is different from the experience of Blacks who have lived here for generations. Although both the U.S. and the African and Caribbean countries have histories of European colonization, the legacy of Blacks from these areas has been different (Tormala and Deaux, 2006). For Blacks the color of their skin feeds into a stereotype that is tied to the entire group. Black immigrants and Black Americans are perceived by those who are not Black in the same way (Tormala and Deaux, 2006). Unless they distinguish themselves in some way such as by accent or native dress, as passer-bys or customers walking around a store, Black immigrants get classified simply as Black and subjected to the same kinds of race-based bias and discrimination as American Blacks.

Social identities can affect behaviors. Threats to social identities have an impact on attitudes, behaviors, and performance. Thomas Tormala and Kay Deaux (2006) posit that among American Blacks the threat of being stereotyped affects academic performance which leads American Blacks to under perform relative to Whites. Waters (1999) also found that there is a disconnect between the Black immigrant and Black American stereotype in terms of achievement and perceived values about education. She found that Black immigrants are often positively distinguished from American Blacks (Waters, 1999). During cogens, this distinction was mentioned by Karen, a student of Jamaican ethnicity, and I explore how this distinction had an impact on the science education of the students in my cogen.

Becoming American

Today, many debate the extent to which it is necessary for immigrants to give up ties to their countries of origin in order to become American. For the European immigrants of the early 20th century, ties to ancestral lands, while not forgotten, rarely played a central role in their daily lives after a generation or two (Butterfield, 2004). Today's easy travel and communication technology, however, make it possible for transnational immigrants and their children to remain active in more than one society, perhaps never fully committing to one or the other (Levitt &Waters, 2002). New York's immigrant neighborhoods are jammed with businesses selling low-cost phone cards and instant money transfers to some of the most remote parts of the globe.

There are sociologists who feel this latest generation of immigrants will not assimilate in the way that the European immigrants of yore mostly did. The questions of what constitutes American culture and what role immigrants should play in it are now being debated publicly in a way that has not happened since the Progressive era, which lasted roughly from the 1880s to 1920s in the United States.

New Models of Immigration

A key proposition of the new models of immigrant assimilation is that, for immigrants of color, becoming American in terms of culture and identity and achieving economic success have become decoupled (Portes & Zhou, 1993). This is a complete reversal of assimilationist models that were based primarily on White European immigration (Portes & Zhou, 1993) and is attributable to a combination of the social capital that immigrants of color bring with them and the racial and ethnic definitions of nonwhites as minorities in mainstream American culture. In other words, many immigrants and their children find that they fare better economically by maintaining a strong ethnic and cultural identification with their country of

origin and resisting assimilation. Remaining immigrant or ethnically identified, this concept suggests, eases economic and social incorporation into the United States: Today, those who resist becoming American do well, and those who lose their immigrant ethnic distinctiveness become downwardly mobile (Waters, 2008).

Social scientists of the mid-20th century saw assimilation as closely tied to upward mobility (Pedraza, 2006). With the waning of the Civil Rights movement in the 1960s, America's ability to overcome its racial and ethnic problems put this notion of assimilation under attack (Butterfield, 2004). In this chapter I present some theories on assimilation as it is viewed today.

Race and Ethnicity

The current 1.5 and second generations share with previous waves of immigrant youth the experience of attempting to reconcile their cultural heritage with the demands of American society. Waters (2008) points out that social scientists previously ignored the possibility that immigrants can improve their prospects for upward mobility by retaining their immigrant culture rather than assimilating. She found that second-generation youths who identify strongly with native-born minorities and whose parents lack the ability to provide them with jobs or to protect them from the influence of the native poor tend to develop an adversarial stance toward the dominant White society similar to that seen among native-born minority children. This adversarial stance often plays out in the classroom, and most teachers respond to it with an equally adversarial attempt to exercise control. Teachers do not understand the lives of the students they are trying to teach, and, when they try to take control, teachers are reacting in ways that would be appropriate to the situation from their own life situations. This has many reasons, one of which Waters refers to as discrimination. I believe that this adversarial stance

can be caused by the constant racialization that these students experience. In the hallways and classrooms at Taft as well as at Suburban Junior High School, this adversarial stance may have been misinterpreted by teachers who did not understand their students' lives.

Parents' Expectations about Race in America

Racial socialization begins at home. Parents' ideas about race and its role in American life shape the childhood experiences of the second generation. Waters (2008) asked her respondents what they had learned both from their parents and through personal experience about race, prejudice, and discrimination. She asked respondents whether or not their parents or the people who had raised them had ever talked with them about prejudice or discrimination against their group, told them not to trust any particular group, told them they had to be better than White Americans in order to get as far in life as White Americans in life, or told them they had to be better than other people in general to get as far as other people did.

She found that West Indian parents were far more likely than Latino parents to tell their children that they needed to be better than White Americans to succeed and concluded that much of this drive to succeed among West Indians is attributable to a substantiated fear of discrimination, awareness of minority status, and a belief that they will have to perform better than Whites in order to achieve equal rewards (Waters, 2008, p. 306). Karen, my Jamaican student, was supported in her academic goals by her mother. She was told by her mother that "Jamaicans always work hard and do well." She expected to do well because her mother told her she would and could do well.

Waters found that native Blacks were much more likely than any other group to report that their parents had talked to them about discrimination (78% for native Blacks versus 56% for West Indians). However, similar numbers of West Indians and native Black parents told

their children not to trust White Americans. Also, Waters's native Black and West Indian respondents were much more likely to get this message than respondents from other groups. West Indians and African Americans also reported discrimination in public places, from the police, and from store clerks (Waters, 2008, p. 305). In a cogen Beautiful, a native Black, a category classification that Waters refers to as an African American, reported feeling that she was the object of discrimination when she went shopping in stores in her local community. She reported that White clerks followed her as she shopped with her mom or with other members of her family. Beautiful was upset when she mentioned that the clerks did not seem to follow White patrons. Karen, of Jamaican ethnicity, shopped in the same stores as Beautiful did and did not report feeling as if she were followed. Tormala and Deaux (2006) feel that first-generation immigrants may perceive racial identity-threatening situational cues differently than Blacks born in the U.S. Wesley Pitts (2007) in his dissertation suggests that a Caribbean American might use Caribbean accents and wear national symbols signaling a different Black ethic and national identity than a Black that has assimilated through various generations. They may feel that this is a way that Black immigrants attempt to avoid being victims of racial stereotypes that are historically associated with and triggered by their skin color. Karen, although not exhibiting an accent in class, may have exhibited in some way that she was Caribbean, thereby avoiding the feeling of being a victim.

In her book, *Black Identities* (1999), Waters wrote that the children of these immigrants from the West Indies originally found that their command of English, marketable skills, community contacts, self-respect, and generally-held optimistic outlook on American race relations helped to smooth their way in America. The realities of American race relations, however, gradually eroded their positive cultural values both as individuals and as

communities. She noted that West Indian immigrants who had grown up in Black majority societies often believed that Black and White Americans tended to racialize encounters too much and that Black Americans sometimes focused too much on seeing discrimination where it might not really exist. Therefore, many of Waters's first-generation West Indian respondents reported that they consciously avoided talking to their children about racial discrimination, both because they expected it to occur less than it actually did and because they were wary of racializing their children. Waters found that those in the second generation who resisted Americanization were most likely to succeed. In cogens Karen revealed her ethnicity; in science class she did not. This seems to be a contradiction to what Waters found. Karen at times wanted to become Americanized when she was in the classroom with other students who represented different races and ethnicities, American Black, Hispanic, and White.

Waters (2008) found a disconnect between the racial perceptions of West Indian, Dominican, Chinese, and South American immigrant parents and those of their second-generation children. Although immigrant parents grew up in societies in which they were part of a racial majority and although they were well aware of racism and discrimination in the United States and attempted to prepare their children to face it, many were wary of imposing a minority-consciousness on their children. West Indians, in particular, often felt that African Americans, to whom they most often compared themselves, had been hurt not only by pervasive discrimination but also by an awareness of their stigmatized status as well. These parents wanted to protect their children from as much of this negativity as they could.

Explicit Racial Socialization

The identification of non-native Blacks is multifaceted and influenced by the history of the immigrant's culture of origin as well as by the labeling of others whom they encounter (Tormala and Deaux, 2006). There is a history of colonization and/or enslavement by foreign

(White) colonizers, but in the Caribbean Blacks received widespread rights like land ownership and education after slavery ended. In comparison, except for a brief period following Reconstruction, basic rights like education and land ownership were denied to native-born American Blacks after the end of enslavement by White Americans. The dual reference points of socialization and identity have affected the way the second generation perceives racialization.

Explicit racial socialization was the norm in many households according to Waters (2008, p. 306). Some Blacks told Waters that their parents told them to expect racism and not to let it get them down. Second-generation West Indians often thought that their parents had underestimated the degree of racism they would face. Waters found that the general pattern was that native-born Blacks and West Indians reported the most prejudice and discrimination. She also found that Dominicans did not show the same sharp differences seen in other groups between those reporting Black ancestry or race and those who do not (p.306). It is interesting to note that the student in my cogen who was Dominican and White chose as her best friend an American Black student.

Perceived Discrimination

Waters's study (2008) shows that the 1.5- and the second-generation population tend to think about race and ethnicity differently than their parents. At the same time few of these young people truly see themselves as mainstream Americans. In their daily lives they balance notions of foreign-ness and of native-born entitlement, of insider and outsider status. This was evident in my class, as Karen modified her self-identified ethnicity depending on the context. In the classroom she was Black, while in cogen she was Jamaican.

In terms of perceived discrimination in school, Black respondents in Waters's book, *Inheriting the City* (p. 314), perceived that discrimination was much more likely to come from

White teachers or administrators who assumed that they were not smart. Teachers who expressed low expectations or negative racial stereotypes were particularly hurtful to those students. This might be the reason for the adversarial stance that Waters reported. Very possibly, it can serve as a defense mechanism against teachers who are causing symbolic violence. When students and teachers do not take the time to understand each others' cultures, they perpetuate the problem of low expectations and negative stereotypes.

Waters reported that by far the most common form of discrimination reported by her respondents happened during shopping or while going to a restaurant. There were reports that shopkeepers followed immigrants to make sure they did not shoplift or actually confronted them to ask them whether they were buying something. Respondents believed that the shopkeepers thought that, because of their race or ethnicity, they would not have enough money to buy the products for sale in their stores (p. 319).

During one of our cogens, three students were involved in a discussion about shopkeepers following them in their neighborhood when they went shopping. Beautiful, an American Black student, had gone to a local mall to buy sneakers and had felt that the shopkeeper was following her. Karen, of Jamaican ethnicity, said that she had not had similar experiences in the same mall, but Torie, an American Black, did.

Academic Impact of Racial Attitudes

In education a perception of immigrants as hard-working could lead teachers to favor a first- or second-generation Jamaican student over a Black student of native heritage, leading to differential rates of success (Tormala & Deaux, 2006). In addition, among American Blacks the threat of being stereotyped affects academic performance, leading American Blacks to under perform relative to Whites (Tormala & Deaux, 2006). The pressure to perform may make for

enhanced performance as well. If teachers assume that Black immigrants are smart or do well on high-stakes testing, this may influence the importance of the tests and encourage teachers to treat these students differently. In cogens Karen repeatedly chastised Beautiful to study more for her tests rather than go shopping for sneakers or hang out with her friends.

Levels of Parent-Child Interaction

Karen, of Jamaican descent, often discussed the importance her mother placed on her doing well in school. I did not hear Krystal, my Dominican student, discuss her parents' attitudes towards school, but she was a hard worker on her own and did well in my class. Torie, a native Black, had an older sister who was in the accelerated class, and I feel that she felt pressure to succeed just as her sister had. Beautiful, also a native Black, did not feel pressured to succeed. In cogens I heard Karen say to her "your mother only cares about you matching your clothes. You'd be better off doing your homework than shopping for clothes." Shantelle, my student of Haitian ethnicity, felt that she had to go to college because her siblings did and because her parents expected it of her, although of all the students in the cogen she had the poorest skills.

Ethnic Options

Immigration has produced diversity in terms of racial and ethnic identity in cities like New York and in communities on Long Island. This has presented science teachers with the challenge of teaching science to students who come from many different backgrounds and who possess varied cultural capital. There is a malleability of racial and ethnic identity in general, and this malleability is found in the culture of Black and Hispanic students who are producing an interstitial culture (learning from each others' cultures because of a mixing of immigrant culture with the dominant American culture). As an immigrant myself, I was also culturally different than my students, thus complicating the challenges faced by everyone in the class as

we tried to understand the cultural capital we were bringing into the classroom. The students in the cogen, Krystal, Karen, Shantelle, Beautiful, and Torie, specifically needed to view me, the teacher, as a resource to support their learning in science. We needed to work together to produce success for others in the class as well.

Suburban School District contains families from many different ethnic groups. In the cogen students were able to see similarities and differences in the way they acted in class, in the cogen, and with each other. My immigrant experience and identity came into play during cogenerative dialogues. I heard my students talking about their interactions with their parents as they tried to live in the world of their parents as well as the world of the dominant American culture, and I remembered similar conversations with my own parents. Discussions in the cogen dealt with how my students who were the children of immigrants had to negotiate ways to leave the family and spend time with their friends who do not have an immigrant background. Krystal offered the fact that her Dominican parents (especially her mother, since her parents were divorced and she lived with her mother and younger siblings) preferred that she come home directly after school rather than join other students in activities after school. Another reason her mother wanted her home was to help her care for the younger siblings. Shantelle also reported that she had to go home directly after school. My own immigrant parents also wanted me home directly after school. I remember asking my friends to ask their parents to talk to mine about participating in after-school activities. Their parents did come to my home, met with my parents, and convinced them that it was good for me to be more active in the school community. I recommended this approach to the students in my cogen, but life is different today. They didn't think that their friends' parents would be willing to talk to their parents. In fact, it never did happen for them.

My minority students also had to learn to live within the dominant culture while they were part of the minority culture. Being White, I was able to fit right in. For most of the students in my cogen, their skin color added an additional dimension as they tried to follow a path towards a successful science education. I had been successful in school. I wanted my students to expand their agency, to be successful in their science class, and, I hoped, progress into more advanced sciences classes as they went forward with their education.

Ethnicity on the Ground

The Dominican first generation tends to be disadvantaged, with many individuals lacking formal education and a disproportionate number of large single-parent families (Waters, 2008). My Dominican student, Krystal, came from a family that fits this profile. Her mother was a single parent at the time, and Krystal had two younger sisters. She reported having few friends at school because her family was new to the school district, and she wasn't allowed to stay at school after regular dismissal, restricting her ability to socialize with peers outside of school. It was during cogens that Krystal disclosed her caretaking responsibilities as well.

Beautiful and Krystal were laboratory partners and sat near each other in the classroom. Beautiful had been in the district since 1st grade, whereas Krystal had entered the district the year that I began my research. At first I thought that they were friends because Beautiful was the first person Krystal had met at school, but in cogen I learned that they lived near each other. They formed a real friendship in class, helping each other during lab experiments. This friendship was extended when they joined the cogen together. During cogen I found that some members of Krystal's family were considered Black, even though she herself looked White.

Who Pays Child Support?

One vignette in the class engendered more trust among the girls in the cogen and improved classroom participation among the cogen members. Krystal was telling the cogen how her mother was struggling to pay the bills since her parents divorced. She asked "why don't Black men pay child support?" Karen looked at Krystal with what seemed like empathy and replied that her dad also didn't pay child support. This particular cogen was a breakthrough in terms of commonality among these students. This experience seemed to bring them closer together. As Krystal revealed that her mother had needed a court's intervention to get the child support her father owed, Karen moved her head towards Krystal. When I mentioned that White men also don't pay child support and have to be taken to court sometimes, my students were surprised. I saw their eyebrows rise, and their eyes seemed to open more. When I asked why they were surprised, they mentioned that they thought that not paying child support was a practice of Black culture and that White fathers would not engage in it. Here was an opportunity, albeit a sad situation, to show them that this despicable behavior is not the exclusive province of these students' own culture. All the students present for this conversation showed increased class participation during the next few lessons in class. They had comradery and expanded agency. They seemed to have each other's backs. When I asked a question, their hands went up. If I picked one of them and that girl got the answer right, the others put their thumbs up in the air to show support. If the cogen student I chose got the answer wrong, the others would complain that I hadn't explained the question properly. I got a kick out of the way they supported each other.

First-Generation West Indians

Although they come from poor islands, many West Indians do arrive with real resources. Most members of the parental generation speak English on arrival and have a high school degree, about one in five have a college degree (Waters, 2008). They also have a high rate of labor force participation, particularly for women, but the percentage of married couples is low (Waters, 2008). West Indians tend to have strong transnational connections, and many respondents in Waters's book had visited their parents' countries of origin several times.

Karen was fortunate because her mother, who is Jamaican, became a guidance counselor and was able to give her daughter advice. I have found that well-educated immigrant parents are likely to communicate with the school about discipline and their child's education, while many skilled yet undereducated immigrant parents feel self-conscious about not having enough training to know how to navigate the school system.

In contradistinction to Black immigrants, most African Americans in and around New York today are descended from people who came North in the great migration during and after World Wars I and II (Pedraza, 2006). The closure of the United States to international migration after the 1920s created a demand in the North for low-skilled labor from new sources at the same time that agricultural modernization and Jim Crow racial restrictions pushed Blacks out of the South.

Educational Attainment in Immigrant Populations

Educational attainment increasingly creates opportunities for young people. Parents who have a low level of education cannot give their children much guidance about negotiating the school system. Some of these parents may be able to get information from social networks formed by other immigrants, experience with bureaucracy in their country of origin, street smarts, or charisma, but I found that during parent-teacher conferences in the Bronx as well as

on Long Island I often have directed parents to get help from the guidance office or school psychologists for their children. These resources were available to them, but they did not know that they were available or whom to contact for the particular problems that their children had. Because of the language barrier and possible problems with their immigration status, many parents for whom English is not their native language have difficulty asking faculty or administration for assistance. I also found that native Black parents did not ask questions about their children when they came to the conferences. In comparison to other groups, these parents came to conferences the least often.

Many investigators have found that second-generation immigrants tend to achieve more in terms of education than their native minority counterparts and, indeed, sometimes relatively more than native Whites. A number of explanations for this phenomenon have been proposed, including Segmented Assimilation (Portes & Rumbaut, 2001); Immigrant Optimism (Kao and Tienda, 1995; Kao, 2004); Peer Support (Fugligni, 1997); and Positive Educator Relationships Suarez-Orozco, Suarez-Orozco, and Todorova, 2007). I examine these hypotheses below.

Segmented Assimilation Hypothesis

The segmented assimilation hypothesis suggests a basic attitudinal and behavioral choice toward education for second-generation children and their parents. Portes and Rumbaut (2001) argue that those who maintain ties to their immigrant parents' ethnic communities practice selective acculturation. Their theory contends that the children of immigrants are at risk of downward mobility into a "new rainbow underclass". They believe that this is especially true for those who attend school with native-born minorities, who, Portes and Rumbaut (2001) argue, have an "adversarial stance" toward education.

In this view, maintaining strong ethnic contacts helps second-generation young people keep a positive attitude towards education. They assume they will succeed. This view predicts that West Indians and Dominicans would be at greatest risk for an adversarial stance because they will become part of this rainbow underclass but that those who have maintained their ethnic distinctiveness and distanced themselves most from their native born-counterparts will do the best. It is of interest that Karen, my Jamaican student, did not distance herself from native-born students in class. She performed above the theoretical expectation for success. It was only in the cogen that she identified with her Jamaican roots, although she displayed behaviors that she felt made her stand out as a Jamaican in class. Karen may have identified as Black in class in order to maintain strong peer-group affiliation with the larger American Black student population in class. She may have shifted her identity in cogen because she felt less vulnerable in the cogen environment.

Immigrant Optimism

Kao and Tienda (1995) and Kao (2004) argue alternatively that immigrant optimism helps to explain the better performance of the second generation. They argue that immigrant parents have higher expectations for their children than do native-born parents. Kao (2004) finds that immigrant parents are more likely than comparable native-born parents to talk about college with their children. My Haitian student, Shantelle, although rarely discussing her ethnicity in either cogen or class, had two siblings who were in college, and she was expected to attend college as well. Both her parents were born in Haiti.

Another hypothesis by Andrew Fugligni (1997) proposes that positive attitudes among students themselves, reinforced by peer support, are also important. He stressed that the children of immigrants were motivated by an obligation towards parents who had made

sacrifices to help them succeed in school (Fugligni, 2006). My Dominican, Haitian, and Jamaican students often remarked in the cogen that their parents sacrificed for them and that they felt a responsibility to do well in school in order to please them.

Positive Relationships with Teachers

Marcelo Suarez-Orozco, Carola Suarez-Orozco, and Irina Todorova (2007) theorize that positive relationships with teachers and other school personnel can have a positive influence on the academic orientation of the children of immigrants. Peer relations and school-based programs can support or impede educational attainment and can provide immigrant students with the practical and emotional supports that middle class, native-born students get from their families (Gibson et al., 2004). If cogens can be implemented as a part of a standard curriculum as well as a research tool, this can lead to more positive relationships between students and faculty. Cogens can be an important part of other school programs like mentoring, which also has the goal of increasing the achievement of marginalized students.

Immigration has also been seen by a straight-line model suggesting that the second generation learns immigrant culture in the home and encounters mainstream American culture in schools and peer groups and through the mass media. In this model the second generation internalizes American culture and identity as it rejects the its parents' culture and labels it foreign (Butterfield, 2004). Assimilation into the mainstream culture of America and the social mobility gained by European immigrants enabled the second generation to move out of the neighborhoods where its parents lived. Many descendants of immigrants left urban neighborhoods that were ethnically segregated and moved to other urban and suburban neighborhoods. White middle class residents of the Bronx started to move into new housing developments such as Co-op City in the northern section of the borough, as ethnic groups of

color began to move into neighborhoods in the south Bronx traditionally occupied by White ethnic groups. The shifting of ethnic neighborhoods was also facilitated by discriminatory housing practices that made developments such as Co-op City mainly available to Whites (Pitts, 2007). My neighborhood was not mono-ethnic, but we didn't learn about the other cultures even though we lived among them. Furthermore, those whose neighborhoods were mono-ethnic often did not understand the culture of the people who were from a different neighborhood. Today in the suburbs this is still often the case.

Ethnicity Shapes Lives

Language Creates Interstitial Culture

In my classroom Black students spoke about dancing to Jamaican rhythms, and West Indian youngsters used American Black slang as they interacted with one another and with me. Hip-hop, for example, got co-opted into the mass media culture almost immediately making interstitial culture more of a possibility. In my class everyday language provided a basis for the production of interstitial culture, thereby creating a foundation on which I was able to build to increase science learning. I discovered that my students' social and cultural experiences affected what happened in my science class. Producing interstitial culture mediates the misunderstandings that can result from having different cultures interacting in the classroom, those of the students as well as that of the teacher.

During my research it became clear to me that, although I considered myself a caring teacher, I had been racializing some of the students, because I did not understand their ethnicities and how they came into play in classroom learning. As resources and schema from social fields outside of the classroom came into my classroom they shaped what occurred there.

As I identified students' cultural capital, I realized that it was different from what I had been taught to expect of students and that therefore I had to modify my expectations. Through my research I examined how classrooms as well as a curriculum could be changed in order to utilize the cultural practices and dispositions of Black students. During the process I learned a lot about issues relating to race, ethnicity, and gender. I began to recognize that communalism is a cultural disposition that is a part of Black students' everyday behavior. It has importance when we look at classrooms where urban teens are students. By understanding each others' cultures, students began to learn how to use their impressive skills to further their goals by participating in the ongoing conversation rather than allowing themselves to be shut down by negative comments from teachers who were not familiar with their culture. Students learned to use their social and symbolic capital and to generate positive emotional energy. We worked on shared goals of completing lab activities and doing well on the exams. I also realized that the culture of the Black immigrant was at times different from that of the native Black student, and I began to examine the culturally specific ways in which Black students take part in school science.

Ties to the Parents' Homelands

A large number of West Indian and Latino parents send their offspring to live with relatives at some point during the teen years either out of fear of the dangers urban streets hold for their children or because a disruption of child care arrangements forces them to (Waters, 1999). Karen and Krystal spent their summers in their respective ancestral countries. They both said they enjoyed spending time with their cousins. Beautiful student spent time in Georgia during the summer, but, when I asked her if she enjoyed herself, she said it "was OK " and

didn't want to elaborate. For all the students, parents made the decision for the trips home to their roots. Karen said that she felt very comfortable in Jamaica. It was a second home to her.

Intergroup Contact

Many of the children of immigrants in New York today interact with each other and with native minorities far more often than they do with native Whites (Waters, 1999). This has important consequences for the patterns of prejudice and intergroup conflict experienced by different groups (Waters, 1999, p.16). Intergroup contact provides for real cultural changes. Interstitial culture and interactions between first-and second-generation groups and native minorities allow for this change.

Today Black New Yorkers dance to Jamaican dance hall music and imitate Jamaican patois; West Indian youngsters learn American Black slang; Puerto Ricans can merengue; and Dominicans can play salsa and rap in two languages. Looking at the music in the dance halls, the eclectic menus in the restaurants, or the inventive slang on the streets makes quite clear the impressive creative contributions to New York of second-generation and minority young people. There is a remixing of global culture.

This creativity played itself out in my classroom and cogens as well. Before class began most mornings, students would practice songs or the latest dance steps that their friends had taught them. Students danced and sang songs of many nations and ethnicities.

Tensions between Immigrants and African Americans

Waters found that tension between new immigrants and African Americans was a dominant issue for West Indians. Karen often chastised the native Black students in the class and in the cogens for not studying enough and for constantly buying new clothes and sneakers. She made her comments in the cogen, never in the classroom during lessons. During cogen Karen criticized people who had been in science class but were not in the cogen. Cogens

facilitated a way for members to drop their social facades and make themselves more vulnerable.

Identity Development for the Second Generation

Varied experiences in school greatly mediate the process of identity development. In my case I learned what my ethnicity meant at home, where the parents of my friends of various other ethnicities were not welcome, and on the streets, where I tried to imitate another group's iconography because I wanted to fit in. School is also a place where Black students learn what their Blackness means. In the case of Karen, a Black teacher noticed her ability when she was in 5th grade and mentored her. She had a positive experience that stayed with her. It is not often the case that minority students are mentored in the school system by role models with whom they have similarities. Unfortunately, many students of color experienced unfair treatment by school personnel. Their preference for intense stimulation, variability, and action are often at odds with school personnel who prefer students who are quiet. Torie felt that she was treated unfairly by the teacher in the hallway.

Often, when second-generation children at school complained to their parents about unfair treatment, they were met with disbelief. Their parents did not believe that the school and its personnel would not act in the best interests of their children. This is an interesting partial contradiction to the idea expressed earlier by Waters (2008) that parents may expect racism but do not want to make their children overly aware of it. The parents' disbelief may have been part of their desire not to stress the racism.

Racial Identity

There has been a long-standing tendency among the White population in the United States to treat the Black population as a homogeneous group. Native Whites generally identify Jamaicans as Black, for example. This tendency ignores how class, gender, and ethnic divisions

shape reality for different groups. Although Black immigrants and their children share an exogenous social group classification with African Americans, they also have the option of identifying as immigrants with a distinct ethnic identity. Karen demonstrated this by identifying herself as Jamaican in the cogen, while identifying as Black in the larger peer group environment. In this way she accesses and manipulates both racial and ethnic markers of group identification.

Given this situation, the question then arises: Does ethnic identity override racial group identification, giving rise to a distinct set of interests or attitudes that separate Jamaicans from African Americans? While many recent studies have explored the self-identities of Blacks, the issue in this case may not be one of race versus class or of race versus ethnicity but may rather be dependent on race, ethnicity, and class, depending on the field. Karen stressed that she was Jamaican American, and, while she may be proud of her Black racial identity, she sees strong differences between herself and Black Americans. In this case ethnic identity overrides racial group identification.

Nancy Foner (2005) states that emphasizing one's distinct Jamaican character is a matter of ethnic pride. When Karen discussed her Jamaican background, she assured the group that this background would prepare her to be "ambitious, a hard worker, and a greater achiever." This is probably a comment she heard at home. Black Americans, especially those with high levels of racial group consciousness, often attribute poor Black outcomes to racism and structural factors. Native-born Black Americans frequently resent what they regard as arrogant West Indian behavior (Waters, 1999). Ethnicity and race played a role in the lives of my students. I found that both cooperation and conflict were present between Karen, a student of Jamaican ethnicity, and Beautiful, a native Black. Karen believed that Beautiful should

spend more time studying than shopping for clothes, but when Beautiful needed help with a genetics cross, Karen was willing to be a coteacher. I feel that this cooperation and conflict was expressed in my cogen group because students felt comfortable expressing their feelings there.

Karen's mother was from Jamaica, while her father was African American. Waters shows that West Indian immigrants often must choose to identify themselves alongside those with similar skin color or to differentiate themselves from native-born Blacks based on their unique heritage. West Indians experience race as a fluid situational category that matters in some contexts but is irrelevant in others (Waters, 2008).

Today, Ethnicity Is Often Celebrated

Waters (2008) found that young adults easily combine their ethnic backgrounds with their American realities. Ethnicity today is celebrated as cultural traditions of the country of origin coexist, merge, and even collide with mainstream American culture. Unlike accounts of earlier European immigrants, these young people rarely feel ashamed of their parents' language and are often proud of their bicultural abilities. Unlike the uprooted peasantry of the 20th century, who told their American children that they could only imagine what the home country was like, contemporary young adults often visit their parents' countries, consume the native country's media, and communicate with extended families by telephone, video, and internet. Aided by technology, my students on Long Island participated in weddings and village festivals in real time. They also often lived in neighborhoods of their own ethnic group and socialized outside of school with those of similar backgrounds, an ethnic differentiator familiar to those who study previous waves of immigration.

Promoting Diversity

Many of the second generation are well positioned to take advantage of institutions and policies for promoting diversity that originated in the Civil Rights era. Indeed, many members

of the second generation in this country owe their very presence here in large part to the 1965 Hart-Celler immigration reform law which ended national origin quotas in U.S. immigration policy. The reality of globalization and the unprecedented diversity that characterizes cities like New York and its suburbs multiply the second-generation advantage. The increasing diversity of American institutions and society is a good thing. The reduction of racial barriers initiated by the civil rights movement, however partial, has created a fairer and thus better society. In fact the use of affirmative action and the active pursuit of diversity have facilitated the incorporation of the children of immigrants. However unintentionally, such policies and practices have helped members of the second generation find their place in American society (Waters, 2008, p. 367).

Nothing is Taken for Granted

My study provided opportunities to examine the taken-for-granted aspects of lessons and to examine ways to understand students. I was able to use the knowledge I had gained in the cogens to encourage my native Black student Beautiful to improve her science skills. During laboratory activities, lessons, and cogens Beautiful was able to expand her agency. Chapter 5 of this dissertation presents several vignettes featuring Beautiful and the way she addresses her discomfort with science questions. In these vignettes the other students in the cogen who help Beautiful also expand their agency and improve their science skills.

My Jamaican student, Karen, spoke during cogens about the importance she placed on education. She told the others that she does her homework as soon as she gets home. She mentioned the fact that her parents, especially her mother, expected her to be an excellent student. The information and guidance Karen had received in a positive way was passed on to help my native-Black student, who had not had this guidance in her life. My Dominican

student, Krystal, valued education, although it was not important to her parents. She also encouraged Beautiful, as did Torie, who is an American Black whose sister was already in the advanced science class. Torie and Beautiful are featured in the vignette mentioned above.

The patterns I observed formed the basis of changing some of the teaching and learning structures in my classroom and led to the proposal of potential ways that science teachers could use students' prior experiences and their cultural capital to enhance the teaching and learning of science. During the process of researching the importance of cogenerative dialogues, I learned a lot about racialization and about the ethnicity of my students. My students learned how to use their cultural and symbolic capital in order to attain their goals instead of becoming discouraged or shut down by negative comments from teachers.

Conclusion

There is a dialectical interplay between social constructions and interethnic or racial relations (Tobin, 2006). Although ethnic distancing and segregation often occur in multiethnic schools, teachers also need to be sensitive regarding the friendships that develop in classrooms among Black, immigrant, and White students. If I had not conducted the cogens, I might never have been aware of Karen's Jamaican ethnicity. Her influence was a positive one, and she was able to help the other students reach for goals that they might not have tried to attain previously. The cogen helped me to be a better teacher by allowing me to understand what racialization is and how it affects students as well as teachers. From this research I learned that second- and 1.5-generation students still face challenges in attempting to reconcile their cultural heritage with their lives in America. I also became more cognizant of the interplay of race and ethnicity in my classroom. The next chapter describes how the cogen formed, how other researchers have focused on using cogens in their classrooms, and how cogens helped students voice their opinions in a manner and place that supported them and helped them

understand their similarities, differences, and contradictions within the context of science class and other nested fields.

Chapter 4

Cogenerative Dialogues Improve Science Education

Change does not come easily. But change is what is needed today in many science classrooms across the United States. I found that cogenerative dialogues helped create positive change in a classroom. Cogens can create new structures within the school which can change the teaching and learning of science. Cogenerative dialogues are a way for students and teachers to accept shared responsibility for teaching and learning. By meeting regularly they can learn to interact in a successful manner with one another. This chapter will explain the importance of cogens in general and specifically for my school district.

The Emergence of Cogens in Classrooms

Katherine Scantlebury and Sonya Martin (2008) found that during the last decade more than 45 university, teacher, and student researchers have written over 50 journal publications, eleven unpublished doctoral dissertations, seven on-going doctoral studies, and four books, all focusing on different aspects of coteaching and cogens. The Scantlebury and Martin article points out numerous studies that are testaments to the benefits of cogens as a methodology for learning to teach. David Geelan et al. (2006) have also talked about the use of cogens to improve the quality of teaching and learning. Sonya Martin (2005), Sarah-Kate LaVan (2004), and LaVan and Jennifer Beers (2005) have all shown that participation in cogens provides empowering experiences for students. In her research Martin (2006) found that successful classroom interactions required the participation of students and teachers alike in structured conversations that explicitly defined and negotiated roles and rules. Beth Wassell and Ian Stith (2004) likened a cogen to a discussion between stakeholders that examines shared events and experiences. Tobin, Elmesky, and Gail Seiler (2005) found that teachers may have difficulty in

identifying the capital that youth use as a foundation for learning science. Martin (2006) found that the notion of shared responsibility is central to discussions as participants reflect on shared experiences, power relationships, and the differing roles and perspectives of all those that are involved. Stacey Olitsky (2006) found that designing lessons that recognize students' cultural backgrounds and interests helped students acquire the skills and knowledge needed for participation in science-related communities. Scantlebury and LaVan (2006) as well as Chris Emdin and Ed Lehner (2006) have used cogens as a research method for examining the social interactions between students and teachers. These studies detail the theoretical and methodological frameworks supporting cogens and provide useful insights into how teachers and researchers can use cogens to catalyze positive change in the classroom and transform social interactions between teachers and students.

Cogens offer teachers opportunities to reflect upon their pedagogical practices and beliefs about teaching and learning. They provide research strategies that teachers and students can use to assess unconscious practices and assumed biases. That is, with cogens the pedagogy influences the research and the research generated through the cogens affects the pedagogy. Cogens are a research and teaching tool. Using cogens in a classroom can help marginalized students to bridge the achievement gap. They also can be used to inform regular classroom teaching.

Ethics of Culture

Emdin and Lehner, former doctoral students in the Urban Education program at The CUNY Graduate Center and now assistant professors in the academic community, have written about the transformative nature of cogens, focusing on the ethical dimension of this practice (Emdin & Lehner, 2006). They feel that, considering the collective goals of cogens and the

tendency of cogens to create transformed communities of practice, researchers must cogenerate a way of addressing ethical issues. They express the belief that a critical look at the ethics of cogens is needed. In Emdin and Lehner's studies participants were high school students who in many cases had been disadvantaged academically, socially, and financially both within and outside of school. These authors make the point that if students are excluded from the cogens, (that is, if cogens were only available to some), the excluded students would not be able to benefit from the increased efforts to transform the educative process.

Emdin & Lehner (2006) also believe that during the practice of cogen, researchers need to be aware of ethical dilemmas that can emerge due to the types of relationships that develop They suggest that it is necessary to be aware that the benefits that participants enjoy during cogens are part of an on-going process. An evaluation of the ethics of the exercise is dependent upon the perspective of the evaluator.

How I Addressed the Ethical Dimensions of My Research

In addition to explaining to my students that we would videotape and audiotape both the cogens and the classroom as a whole, I explained that I would keep anything they said confidential and would not use their real names in anything that I wrote. The students would be allowed to choose the names that they would like me to use in my writings. I explained that I would study how the students and the teacher (I) talk to each other. After I collected the videos, I noted, I would discuss what I saw together with the students and look for ways to improve the quality of teaching and learning science. Students signed assent forms, and a consent form was also signed by their parents or legal guardians. I told the students that they could withdraw at any time from the study, but nobody did.

What I Learned about the Culture of Power

There are inherent power imbalances in the teacher-student relationship which are amplified by students being research subjects. Michel Foucault (1983) felt that this was of concern particularly because of the multiple imbalances in power that can occur between the researcher and the researched in any qualitative research setting. In my case these imbalances were present in the cultural differences between me, the teacher-researcher, and the youth in my class. There were disparities in education, in income, and in experience with and within the culture(s) of power. I was a White, Jewish, middle-aged, and middle-income female teacher with a Master's degree. My students, whose parents' education and income varied to a great extent, were of various ethnicities.

Critical ethnography seeks to counter the potential forces of oppression that serve to reproduce social injustices experienced by students and teachers in education and educational research. Joe Kincheloe (1998) talked about a sense of "critical awareness". According to Kincheloe, this awareness can end both the inevitability of this situation and a simple repetition of the existing power relationships. It accomplishes this by allowing students' and teachers' agencies to direct themselves toward a clearer understanding of the obstacles that prevent their access to and/or appropriation of the resources that they will need to reach their goals. For this reason collaborative research is seen as instrumental in identifying both "sites and strategies by which transformations can be accomplished" (Kincheloe, 1998).

What I Learned about Power Imbalances

Traditionally, the ways in which teaching and learning have been established have created an inherent power imbalance between teachers and students. Usually students accept that their teacher knows what is best for them, and parents who disagree can arrange to speak to the teacher or the principal directly. The participation of students in this study likely reduced

these power imbalances and gave students a voice in how to improve the quality of both the teaching and their learning. In my research I reduced and minimized other power differentials that are inherent in the traditional roles of teacher and students. Martin (2005) and LaVan (2004) have also shown that participation in cogens provided empowering experiences for students. In this dissertation I look at ways that students' cultural capital can be utilized and how classrooms can be restructured so that cultural practices and dispositions provide social and symbolic capital for urban Black students.

How Teachers Can Make Sense of Practices and Intentions

In many classrooms good teaching focuses on teachers being able to control students (Tobin, 2005). This issue of controlling others is especially important when the teacher and students are from different race and class backgrounds because they may not understand either each other or what is expected in the classroom. Students and teachers may have difficulty making sense of each others' practices and intentions. The situation becomes more complicated when some of the students and some of the teachers are from the same race and class, while other students in the same classroom are from a different race and/or class. Some cultural practices and interactions may appear to be disrespectful to teachers or administrators who come from different environments and who are not familiar with the lives of the students with whom they interact. Students in a classroom who hang around in groups because they value social bonds and responsibilities over the individual may seem aggressive to school personnel who might prefer a more quiet, docile class. In my school teachers and administrators did not want students to congregate in the hallways before or after classes or during class-passing time. Many minority students valued this time together. Teachers preferred that students come in quietly to the room and get ready for class immediately, and would often raise their voices and

yell at students to get into class and start working. Before I began my research, I preferred that students come in quietly and begin working immediately as well.

When struggles for control occur, the quality of learning diminishes, resulting in teachers being judged as ineffective or classified as poor educators. In order to avoid this, teachers try to establish control over students--especially over students whom they feel are disruptive. Once students enter the classroom, teachers expect extraneous talk to stop and that students neither be part of a social group nor to talk to each other. This produces impediments to teaching. Attempting to establish control does not end up being an effective teaching tool in high poverty (underclass) urban (Tobin, 2006), rural (Tobin, Yerrick & Roth, 2004), or suburban schools. Teachers need time and experience to adapt their teaching to the cultural capital of the youth with whom they are in contact. Similarly, youth need time and experience to adapt their cultural capital to teachers who differ in age, race, and class (Roth, Tobin, Elmesky, Carambo, McKnight, & Beers, 2004). I needed time to adapt my teaching style to the cultural capital of my students. I also needed time to understand that some of my students were more likely to be sensitive to emotional cues and be more expressive emotionally. This was the case with Dee who was upset during a lab activity because she thought I had yelled at her. In Chapter 6 of this dissertation I describe this episode, and I also discuss a vignette in which a teacher's need to control led to an uncomfortable situation which was discussed in a cogen with my students. This latter episode involved a teacher who did not understand that some students place a premium of feelings and who just didn't care that he did not.

Teachers may have difficulty identifying the capital that youth use as a foundation for learning science (Tobin, Elmesky & Seiler, 2005). I found that teachers may perceive Black students as lacking the culture they need to support the learning of science. Teachers may not

recognize the potential of what these students can do as a foundation for learning science. Teachers need to earn the respect of students, show an interest in what they do, listen to and comment on what they say, and assist students to be successful. Sometimes from a student's perspective a struggle for control occurs, and the teacher is set up as an authority figure to be disrespected. A student can earn the respect of peers by disrespecting his or her teacher. In my class at the beginning of my research, Dee did not pay attention to a request from me to keep score on the whiteboard, and she chose not to answer a question when called on. Even when she offered an answer, she did so in a manner that seemed resentful. I do not know if she was disrespecting me or not, and I did not discuss this with her in a cogen, but other students in the class may have seen this as disrespect and may have subsequently been more likely to disrespect me as their teacher. The struggle that results serves as an incentive for students to disrespect teachers and be uncooperative.

Students who cannot use the culture from their own experiences as a foundation for learning science may eventually feel alienated and powerless. Unable to participate in a lesson because they do not know how to participate in the classroom, such students may be loud and social, talking with each other in class. The teacher may expect quiet in the classroom, and clashes between the students and the teacher may ensue.

The Importance of School in Students' Social Lives

I explored Pierre Bourdieu's (1986) conceptualization of cultural capital, the transmission of cultural capital, and habitus as my science class worked through laboratory experiments. In Bourdieu's work habitus can be defined as lasting acquired perceptions, thoughts, or actions. Students can internalize a place-in-society which will then both affect friendship choices and place constraints on the social capital available to individuals. I saw how it had an impact on. As my students and I explored lessons and laboratory procedures in

the cogens and my classroom, I found a contradiction here because Beautiful and Krystal were friends, as were Karen and Beautiful. Students in my class did not only seek out friends who were similar to them in ethnicity.

The Challenge in Science

Children need to understand the principles of science. In an age when computer science, medicine, pharmaceuticals, and other technology-related fields are the economy's most dynamic growth sectors, science is important to children's futures and to the future of the nation. In many schools today children are at risk of scientific illiteracy. Unfortunately, many believe that tests are the best way to measure student literacy. Many students are unprepared or unwilling to prepare for these tests.

In an interview in the New York Sun on March 16, 2006, Diane Ravitch, a research professor of education at New York University, critiqued the policy of the department of Education in New York State on testing:

> Students are not progressing because the department is committed solely to test scores and not to learning. The relentless pursuit of higher scores has led to a heavy investment in test preparation activities, at the cost of a sound education. Students are spending endless hours practicing to take tests and taking tests, but are not gaining the knowledge, vocabulary, and understanding that come from the study of science and history and other neglected subjects.

Correct as that may be, in New York State, students must take the 8th Grade Intermediate-Level Science Test. Because my school was in New York, it was my job to help my students obtain successful results on the exam. I hoped that cogens would help my students achieve this goal.

Research such as that done by Roth and Tobin (2001) likens cogen to a discussion between stakeholders that examines shared events and experiences. Cogen provides a neutral field in which participants can discuss power relationships as well as the roles of participants

(Seiler, 2002). Cogen also considers individual and collective activity, goals, roles, equity issues, curriculum, and shared responsibilities. Shared perspectives are used to inform emerging understandings of classroom interactions, of the quality of these interactions, of participants' practices, and of how these patterns of interaction can contribute to the collective activity of teaching and learning science. Conversations are crucial in raising consciousness about different participant perspectives--thereby providing a means of addressing social reproduction--by examining the sites of successful and failed interactions, which can then be transformed to improve teaching and learning (Martin, 2006).

Cogens Teach about the Interplay between Social Constructions and Racial Relations Classrooms

There is a dialectical interplay between social constructions and interethnic or racial relations. Although ethnic distancing and segregation often occurred in my multiethnic school, friendships developed between native Black, immigrant, and White students as well. Teachers need to be sensitive regarding the friendships and relationships that develop among these students. Beautiful gained agency because her friends helped with the execution of a genetics cross with which she was having trouble. Krystal gained social capital because she was friends with Beautiful.

What I Learned about Improving Experiences of Marginalized Students

Some research in the United States has investigated the practices of students and teachers in urban schools with hopes of improving the experiences of students who have traditionally been marginalized away from success in science. The cogens helped me to be a better teacher by allowing me to understand what racialization was and its effects on students as well as on other teachers. I began to understand that students may be bringing in music and dance as cultural capital into the classroom. Rather than being upset that a student may be

listening to an ipod or humming or during class, I realized that during a lab activity that was ongoing it might be possible, as well as enlightening, for music to be a part of the lab activity for a student. From this research I learned that female students of color who come from immigrant backgrounds face challenges in attempting to reconcile their cultural heritage with their lives in America. Participating in the cogen helped to transform my students into more responsive and active learners. Teaching and learning are both cultural undertakings. The subculture in the classroom can begin to change when both the teacher and the students begin to identify themselves as a unit with a common objective of learning and doing science as an enjoyable and challenging activity. When students from the cogen became more involved in the classroom activities they encouraged others to become more active as well. When we played a game as we prepared for an exam, the students from the cogen helped to raise the interest level in the game and the energy level as well.

Why I Set Up the Cogen

At Suburban Junior High developing an identity connected to school science may be more likely if a student identifies him- or herself as college-bound or if a student is willing to align him- or herself with a privileged group in an unequal economic system. These students usually have advocates and advisors who are ready and willing to help them. At Suburban Junior High School, as in many schools across the United States, inequalities in income and education between Blacks and Whites become associated with race as well as class biases. Additionally, gender issues also have an impact on learning, achievement, and life paths. Mentors are few and often not assigned to help marginalized students.

Paul Willis's study of resistance in *Learning to Labor* (1997) showed how young people in subordinate groups drew on multiple sources of influence to fashion their own

responses to conditions they experienced. At Suburban Junior High School students' responses to being shut down or feeling that they were being disrespected led to behaviors that were perceived as disrespectful by some teachers and administrators. During cogens in my classroom, students enacted their culture and learned about other cultures as I learned about theirs. Together, we made inroads that made an impact on learning, achievement, and life paths.

What I Learned about Authentic Research

Consistent with the reflexive approach that has been adopted by many ethnographers who are concerned with how their work may contribute to social justice or injustice, Egon Guba and Yvonna Lincoln (1989) have argued that simply conducting qualitative or ethnographic research is not enough. Their influential criteria for authentic research provided an investigative model that draws on an ethical perspective and that also hopes to counteract the potentially negative impacts on communities involved in research. Their criteria include: Fairness; an emphasis on increasing the understanding of each others' perspectives toward ontological authenticity, which "refers to the extent to which individual respondents' own emic (that which is important to the actor rather than the observer) constructions are improved, matured, expanded, and elaborated in that they now possess more information and have become more sophisticated in its use" (Guba & Lincoln, p. 9); and catalytic authenticity, which requires working with participants toward positive change in local settings. Meeting these criteria requires a higher level of involvement with those who are being researched. Reaching Guba and Lincoln's goals demands a greater level of reflexivity as well in order to evaluate research on an on-going basis. Following ethically-based criteria, researchers concerned with the intersection of ethics, means, and outcomes have attempted to be authentic and catalytic by employing methods such as collaborative/action research (Elmesky, 2001).

In answering my research questions using cogens, I have adhered to these criteria. In terms of fairness, in the cogens we increased our understanding of each others' cultures. Ontologically we improved our basis of information. I was able to educate others in our school on the importance of cogenerative dialogues. Catalytically I was able to effect change in my school district and increase the number of marginalized students who were enrolled in the advanced science classes at our school.

What Students and Teachers Leaned about Activity Theory and Forms of Capital

Students and teachers bring their capital into the classroom. In his 1999 work on activity theory, Yrjo Engeström explained the role of capital in social life. In his work on capital exchange, Pierre Bourdieu (1986) described how forms of capital are exchangeable and how they have a powerful influence both on people's social positions and on their ability to attain their goals. People's status is determined by how much cultural or symbolic capital they possess. Culture is also a source of domination, in which the mainstream plays the key role in terms of education and educators function as specialists of cultural production and creators of symbolic power. Bourdieu argued that the habitus of the dominant class is used to legitimize social differences. Expanding on Bourdieu's work, Jay Lemke (1990) made the point that unfamiliar language, content, or approaches to argumentation can sometimes exclude students from science classes. Cultural capital can also be thought of in relation to the exclusion of those with less power from domains controlled by those with more power (Olitsky, 2005). In cogens the students and I learned how to exchange cultural capital for social and symbolic capital as I sought to tweak a state-required curriculum and help students develop a science identity. Dee and Ebony, for example, used their cultural capital and earned social capital as they became part of the game we played. According to Bourdieu, social capital resources are based on group

membership, relationships, networks of influence, and support. Cultural capital is made up of the knowledge, skills, education, and advantages that a people have, which give them a higher status in society. Parents provide their children with cultural capital by transmitting the attitudes and knowledge needed to succeed in the current educational system. Symbolic capital comprises the resources available to an individual on the basis of honor, prestige, or recognition.

An activity-theory perspective can provide insights into how social and cultural capital can mediate people's ability to achieve their goals in particular settings. Engeström (1999) views activity as a collective endeavor. With this perspective he sees the path between the subject and the goal as mediated by components such as rules, resources, and the division of labor. Students' and teachers' cultural and social capital can be considered resources that participants can use to achieve their goals within a classroom activity. However, contradictions, inconsistencies, and conflicts between and within those components can interfere with students and teachers being able to meet their goals. For example, low student achievement and low confidence in science can be seen as partially resulting from a contradiction between the resources that the teacher expects students to have for learning science and the resources that students actually bring to the classroom. In my class Beautiful had low confidence in her ability to understand science. She had the same resources as Torie and Karen, but she was not able to understand the material until her friends helped her understand it. Studies have shown that in urban classrooms students' cultural capital is sometimes not valued, which can impede their science learning (Seiler, 2002). Applying activity theory provides ideas of several ways to bring about change. One type of change in a system occurs when participants work together to eliminate contradictions and strengthen patterns of coherence (Engeström, 1999), thus fostering

the achievement of both collective and individual goals. In this research project we worked to eliminate acting only as individuals. As the class and I learned about each other and worked through laboratory activities, we were working for better grades on the 8th grade science exam for all and a better understanding of each others' lives.

Building Community, Creating Student Engagement, and the Role of Respect

Students were active co-teachers and helped their peers in the class solve problems. Torie and Karen helping Beautiful complete a genetics cross was one incidence of this. The focus for dialogue involved a shared experience of being together in a classroom and of participating in classroom activities. All participants needed to take responsibility for providing and accessing structures so that the individual's and the groups' science education was successful. Conversations in the cogen among students were respectful. I found that it is important to work in groups and to do the kind of science that uses the lifeworld of the student. In the next chapter I discuss the research that my students and I conducted during the first of my two years of studying the importance of cogenerative dialogues in my science classroom.

Chapter 5

Creating Capital through Participation

Students create reservoirs of capital through active participation in their lives, but most of their teachers have very different life histories, and the capital they have developed and experienced is different from that of their students. They may therefore see their students' efforts to participate as inappropriate and in need of change. Because fields have no boundaries (Tobin, 2006) and culture belonging to one field comes into class and then gets enacted in other fields, teachers need to recognize and support students' practices that come from other fields. By recognizing and supporting different cultures and the way they are enacted in class as well as by understanding each other's lives, teachers can provide students with a foundation for success. Teachers who are not aware of the learning potential of practices and schema that arise outside of the classroom might shut down these practices. In addition, if teachers or other students discourage practices that might have been helpful to learning because they are afraid of losing control or they do not understand students' practices that come from other fields, the students who are shut down may experience frustration, disappointment, annoyance, irritability, and resentment (Tobin, 2006).

Shutdown strategies by teachers can be unconscious or conscious. These strategies might involve just a facial expression, a gesture, or a movement of the body. Practices that teachers may shut down can include students walking around the room, social interaction among peers, forms of argument that are loud and seemingly aggressive, and rhythmic tapping and body movements (Elmesky, 2003). If shutdown strategies persist, students can experience a buildup of negative emotional energy and a decrease of interest. I looked for these shutdown strategies in order to avoid them as I worked with my students. Some examples of my own shutdown strategies prior to my cogens include the way I encouraged students to enter my

classroom as quickly as possible and not hang out in the hall. In addition, I wanted the students to file in quietly. I chastised any student tapping on a desk or calling out an answer.

Agency and Identity Development

In a classroom the use of cogenerative dialogues can provide a strategic intervention to expand agency. School learning should be expansive and lead to wider possibilities for action (Roth & Barton, 2004). Science learning is the goal in my classroom and can be a tool for achieving expanded agency. This is especially true if students can utilize their own resources to build new ways for making the world theirs. They should be able to make the world of science a part of their lives. For students who are eligible for the higher-level science classes, the Suburban School District has made attempts to achieve the goal of making science a part of their lives by creating structures (classes) that can be appropriated (students can participate in), thereby expanding students' agency. The problem seems to be that many students are not able to access these structures. Children with the greatest needs are often concentrated in school districts that have few resources. Our school has had results similar to those of other high-needs schools in our area in terms of Regents scores and other New York State exams scores. When compared to the wealthier districts on Long Island, however, our district is well below the median in achievement on Regents exams and other New York State exams (New York State Department of Education, 2005).

Cultural sociology embraces a dialectical relationship between agency and structure (Sewell, 1999). The agent (student or teacher) is socialized in a field where various form of capital are present (Bourdieu, 1992). For a student to have agency the student must have access to the resources of a field and the cultural capital necessary to appropriate these resources. Individuals use resources to meet their goals and, therefore, to change schema and practices. Schema and practices become part of the dynamic structure of a field and in turn become

intertwined with the agency of all participants. In a classroom, practices are patterned actions that are enacted in a field, often without awareness and in accordance with the agency|structure dialectic. When they are enacted, practices become part of a field's structure and can then be appropriated by all of the participants. Structure is the patterned arrangements which influence or limit the choices and opportunities that an individual possesses.

In a science classroom, if a student is not sure what a hypothesis should be, the discussion about its meaning becomes a resource for students who are trying to come up with a hypothesis and for all students who experience the discussion, whether they are involved in the discussion about the selection of the hypothesis or not. In terms of lab experiments, the equipment and directions are the resources available to students. Students must use their agency in order to utilize the lab equipment in the proper way and work through the laboratory experiment.

Social life occurs in multiple fields that may be nested, may partially overlap, or may be somewhat independent (Tobin, 2006). Tobin's research reveals that people experience life as schemas based on memory of past experiences and as projections of what is to come (also as the unfolding of cultural enactment). They do not experience life only as it is lived with its unfolding experiences (i.e., only as praxis). Praxis is an informed, committed action that embodies a respect for others.

Micro-, Meso-, and Macro-Analysis

To explore social life in my class, I analyzed, elicited, and supported findings by investigating social life as it was being experienced by the teacher and students, at the micro-, meso-, and macroscopic levels. I catalyzed social transformation by identifying contradictions within structures like my classroom, and I found ways to alter those structures and therefore to

expand the agency of all those involved during cogens and class lessons. I showed how marginalized students like Beautiful can feel capable in a science class and I encouraged my school district to expand the advanced science classes at our junior high school so that more marginalized students could be involved. Tobin (2005) found that at the micro level, agency is enacted as individuals interact with structures, accessing, appropriating, and reshaping them, often without conscious awareness. As I studied the videotapes I became aware of how my students in class as well as the cogen were using the resources I provided them and how after cogens they were able to reshape these resources and become more agentic and interact with other classmates with more confidence. At the meso level, he found that participants enact roles as time unfolds. As video- or audiotapes were recorded and field notes were written at a fixed place and time, these tapes and notes became resources for my interpretive research. These were produced in real time and were not manipulated in any way.

Culture is continuously enacted in a lifeworld that consists of multiple fields. The culture which is produced in fields outside the classroom can be enacted without participants being aware of the action. A science classroom can be considered a field. In this case, fields that are nested within the classroom include class lessons during which a teacher is at the whiteboard, students taking part in lab activities, and one-on-one interactions. The science classroom is nested within the school, which is nested within a school district. Within the school field there are many fields including the principal's and assistant principal's offices, the guidance office, the attendance office, the hallways, the lunchroom, the entrance, the security force, and the teaching assistants. These overlapping and nested fields are places in which capital is produced in a helical cycle of cultural, social, and symbolic capital (Tobin, 2006).

Capital is produced as Fields Intersect

It is important to determine the extent to which capital produced in a field can be used to attain goals in other fields. It is equally important to understand the way in which individuals restructure the fields in which they participate. Fields intersect. Individuals are conscious of what has happened in other places at other times and may think about what has happened in these other places and times, thereby changing the structure of a field (Tobin, 2006). The use of language and the common participants of a field produce resonances that then encourage particular stocks of knowledge that then come to hand (Schutz, 1963). For example, when a teacher and student interact, a teacher's question and the actions of the teacher and student such as gestures, facial expressions, and body movements are all experienced by all participants as structures. These structures are interconnected by the agency of all participants who act to use the structures. This transaction involves capital production as stocks of knowledge come to hand, simultaneously reproducing and transforming the field (Tobin, 2008).

Emotional Energy and Synchrony

Using the work of Collins (2004) as a theoretical framework, I sought to understand interactions and the extent to which they become resources for creating a community of learners and contributing to a positive learning environment. I did this by looking at emotional cues like gestures and body positioning as well as students' emotional expressions that I observed during cogens and classroom activities. Emotions can have a positive or a negative valence. Collins explains that successful interactions are associated with positive emotional energy and unsuccessful interactions can lead to a buildup of negative emotional energy. In my classroom I tried to avert a sense of failure in my students by minimizing the incidence of negative emotions including anger, frustration, boredom, disappointment and powerlessness. I encouraged a learning environment which produced positive emotional energy. I found the

indicators of enjoyment, happiness, interest, satisfaction, freedom, independence, success, and feeling valued. The videotapes and audiotapes allowed me to observe and study and focus on gestures, bodily movements, verbal interactions, orientation and physical spacing of the participants and solidarity and mutual focus as it emerged among members of the cogen and the class. In the next few sections of this chapter I interpret selected vignettes helped which helped to promote shared understandings and collective responsibilities as well as insights into possible ways that power and accountability in my classroom could be redistributed. Videotaped incidents were also selected if they proved salient to the quality of teaching and learning. The interpretive nature of this type of research creates the ability to focus on all the participants and activities in my classroom. It allowed us to review activities that could have been missed if they were not videotaped and viewed at a later time. By replaying the videotape, patterns were discerned and contradictions seen. Videotapes served as a tool for discussion during the cogens and were a reference for changing classroom structures. The students in the cogen looked at tapes during our lunchtime meetings. As an example, in the first year of the study we looked at a tape about a lab we did about solubility. We noticed that Ebony as the only student who walked directly up to the camera to say hello. When we discussed this Ebony said she was expressing herself and being spontaneous. This was one of Boykin's nine dimensions of which characterizes the way Blacks perceive, interpret and interact with the world. I was beginning to learn how these dispositions impact learning in the classroom.

Interactions

Synchrony and Asynchrony

Synchrony is seen as the concurrent interactions by students and teachers. From the videotape I noticed that as I explained a lab procedure, students nodded their heads to indicate that they were following my oral presentation. If they didn't nod their heads I would ask if

everyone understood what I was saying. Often I would ask students in the class to explain in their own words what they heard me say. I would look to see if students nodded their heads then. Also, when I told a joke, the students smiled and laughed. Evidence of synchrony were eye contact, head movement, body orientation and movement, facial expressions, gestures, verbal utterances, writing, and interactions with peers and classroom materials (Collins, 2004). I learned that it was important to look for these cues. It was a signal that they were on track for a successful interaction. The students looked at each other as they were involved in laboratory activities and the games that we played. During cogens students moved their heads towards each other and oriented their bodies towards each other as they became more involved in the conversation and as they discussed topics that were brought up during the cogen. Students exclaimed words of pleasure or concern as they interacted during laboratory activities, game playing, or cogens. Facial expressions and gestures indicated agreement or anger as topics such as power issues and racialization were discussed in the cogen. When laboratory activities and game playing were occurring students engaged in writing as they interacted with peers and the classroom materials. Successive synchronous practices can lead to interaction chains that can connect and build on one another (Collins, 2004). In my classroom and during cogens one conversation led to additional conversations which led to interactions that helped us to learn more about each other and teaching and learning practices. When we were talking in a cogen about friends Beautiful blurted out that Krystal had no friends but her. This led to a conversation about Krystal's home life and her need to be home after school to take care of her younger sisters. This had both a negative and positive result. Krystal said in the cogen she didn't need more friends. When we talked later one-on-one, however, she admitted that she did want more but didn't know how to make them because she was not able to go to anyone's

home after school or have them to hers. I suggested she try to talk to her mother about staying after school for some school activities, but she was reluctant to ask her. The positive result was her ability to share her private life with us; the negative was that we couldn't come up with a solution for her. I did notice the girls in the cogen interacting with her to a greater degree when in class activities.

Asynchronous interactions are also possible such as students shaking their heads in frustration at an unclear explanation of a procedure or assignment or if they are made uncomfortable in the classroom. A buildup of asynchronous practices can disrupt the fluent enactment of culture in the classroom and when a lack of synchrony occurs, negative emotions can build up (Collins, 2004). There can be many reasons for asynchrony, including an inability or unwillingness of participants to access and make use of particular resources. Individuals may resist forms of cultural enactment and intentionally produce or reproduce different or unexpected culture. In other words, they may use agency to create asynchronous interactions, using resources in ways that are unexpected. That happened in the experiments in which Dee and Ebony participated. Dee didn't want to participate in the activity because she thought I had yelled at her. She was also not going to complete the lab when she dropped the car, but, when she was encouraged by the group, she completed the task easily. Ebony also did not want to participate in an activity, so she sat at the front of the room putting on lipstick instead. Through cogens they were made aware of their asynchronous behavior and we worked on transforming this behavior into synchronous behavior.

Contradictions Arise

Contradictions can occur because fields have no boundaries, allowing individuals who experience social life in many fields to enact culture that is not normally associated with the

field in which the enactment occurs. Contradictions contribute to fields having changing structures, which afford different forms of agency, identity construction, and social life. The dynamic structure|agency relationship in a science classroom may not support the collective interests of students and teachers. Examples of this in my research were the way in which Dee and Ebony chose initially not to participate in lab activities and the way that Torie felt she was disrespected by a teacher in the hallway with whom she had a pre-class altercation. Cogens helped to produce the cultural alignments that are necessary for participation and understanding. With Dee and Ebony we looked at the videotape of the activity, and we discussed why they had chosen not to participate. With Torie's situation, we discussed the matter among the other students in the cogen. This discussion and the comments it engendered is related in greater detail later in this dissertation.

When a lack of synchrony occurs, contradictions can arise. For example, if teachers in the hallways and classrooms disrespect students who come from a minority subculture or if students disrespect teachers, it may be because the students from minority subcultures experience structures that resonate with capital produced in other fields and enact forms of culture that are contradictory to mainstream culture. For example, teachers may misconstrue loud boisterous behavior on the part of Black students as disrespectful, when students are just being social and friendly (Boykin, 1986). Dissonance may also be created when students created asynchrony with their teacher. When I asked Dee to post results from a game on the whiteboard and she refused, she was responsible for asynchrony with me. In the next chapter of this dissertation I present a vignette in which one of the students in my cogen and a teacher present a lack of synchrony because they misunderstand each other.

Mutual Focus

When I asked a question in the class, a successful interaction meant that others heard the question, understood what I had asked, knew that an answer was expected, and agreed to create and volunteer a response. The likelihood of an interaction chain's success increases when participants understand one another's perspectives, take them into account, and anticipate how other participants will act.

Mutual focus can contribute to successful interaction chains. Participants in a classroom establish a common focus for an activity, like an object (tool) in a lab experiment, and then understand the object from the perspective of others. Resources for mutual focus in science classrooms include writing on the whiteboard, charts and textbooks, equipment, materials, and verbal interactions among participants. Mutual focus is more likely to occur when participants share space, orient their bodies to face one another, and position their heads so they can maintain eye contact. Mutual focus is facilitated when participants in a classroom have shared goals and understandings of desired outcomes (Tobin, 2006). In a vignette later in this chapter, cogen members Dee and Ebony and the rest of the class show synchrony, mutual focus, and solidarity as they learn science by playing a game in class.

Producing Fluent Interaction Chains

At department meetings, when I introduced the concept of cogens, I explained how using the use of cogens could help stakeholders understand why solidarity should be looked at from a positive perspective rather than from a deficit perspective. In both the cogen and the class I encouraged students to embrace the concept of solidarity. We discussed how it could be an empowering force in our laboratory and class activities. The larger class was aware of the existence of the cogen and its goals, but the cogen group did not share their understandings

with the larger class. In retrospect I feel that I should have had the entire class as a cogen as well, so we all could benefit directly from the understandings that came about from the cogen, rather than have the results just play out in the class.

Solidarity

Solidarity is about belonging to a group. It is a form of symbolic capital that grows from social networks and successful interaction chains that produce positive emotional energy and coherence in the actions of participants in a field. Solidarity occurs within a community when positive emotional energy, mutual focus, synchrony, and chains of successful interactions occur. Solidarity also occurs when people who live together and experience similar culture look out for one another. This is especially true for people who experience lives of hardship. The social networks that Blacks prefer and that are part of their social fabric encourage the buildup of solidarity in a classroom (Parsons, 2008).

The Study Challenge: Learning Science by Playing a Game

Every Friday starting in January, my students played a game that involved asking questions that could appear on the Grade 8 Intermediate Science exam. We also played this game during cogens as we attempted to improve the teaching and learning of science in the classroom. We played the game both years that I was involved with this research. In the first year, Dee and Ebony were the only participants in the cogen. The vignette I present next took place the first year of my research. I was just beginning to understand that, despite the variability among Blacks as a group, there are characteristics in common that define the way they perceive and interact with the world, and it is different in many ways from mainstream educational practices.

The students in the class had small whiteboards and four colored markers at each lab station. There were four people assigned to each of 6 teams assigned to tables labeled A, B, C, D, E, and F. I began by orally asking the questions, and then I put the questions which the students were to answer one at a time on the overhead projector. Each table had one whiteboard. The students had three minutes to discuss the question, formulate an answer, and write it down. When I called time, one student from each group held up the whiteboard. I looked at each whiteboard and told them whether they got the answer right or wrong. The lesson took place first period and I asked questions about density. I had shown the class water in a graduated cylinder, and oil in a graduated cylinder. I asked them what would happen if I poured both liquids into a third graduated cylinder. One student called out that they would mix. I asked the class how they would mix. "Would one be on top of the other?" I asked them to put their answers on your whiteboards. "Would the oil be on top or would the water be on top, or would they mix together?" The students all wrote that the oil would be on the top. "Yes, yes, yes, yes, yes, yes" were the comments they heard from me as they held up the whiteboards. Everyone got it right. "Everyone gets a point." I clapped my hands over my head in appreciation of their involvement and the correct answers. They excitedly yelled "whoooo." Many clapped their hands loudly. As we continued to play the game, if someone got something wrong, I would say "not quite. Who else has an answer?" As I looked around the room the students most of the students were gazing at each other, heads were moving towards each other; their gestures and smiles indicated mutual focus, synchrony, and solidarity. It looked like it was going to be a good start for the class. Dee and Ebony however were not participating as the other class members were.

The Contest Begins

As the first contest began and as students were responding to my questions, some sat on the lab tables; others stood by the tables, and a few students were lying across the tops of the tables. I thought that in my classroom, without even realizing it, I had been teaching an inquiry-based curriculum situated in a Black Cultural Ethos (BCE)-infused context (Parsons, 2008). This BCE-infused context encouraged the building of social relationships by permitting side talk, playfulness, and socializing of the type that integrates sociality into task completion.

As the first contest began, Dee sat at the front of the room. She was biting her nails. She just looked at me while I interacted with the class. She did not want to be part of answering the questions, so I asked her to be the recorder for the game. Dee was to record the results on the large whiteboard at the front of the room. She was not interested in this job either. When students complained loudly that she didn't give them credit for a correct answer, she replied in an indignant tone of voice "I didn't have enough time." However, she didn't get up to put the point on the whiteboard. Her eyes rolled up to the ceiling. She was not exhibiting synchrony.

I asked the class if anyone else would like to be the scorekeeper. Several other students volunteered. I picked one of the volunteers, and he came up to the front of the room. Dee just kept her seat (which was my chair), and the other student stood and became the new and animated scorekeeper. This student turned out to be an excellent scorekeeper. He quickly and correctly posted all the scores. The students participating did not complain anymore. The students were actively watching as the scores were being put up. There was mutual focus. They wanted to make sure they were put up correctly. "We're winning" kept being called out. There was synchrony. The teams calling out "we're winning" changed as the scores were put up.

There was solidarity in the class, but Dee was not involved in it; she began looking at the papers I had on my desk.

Originally, Ebony also chose not to participate. She sat at a desk facing Dee. Ebony tapped her fingers on the desk, but she got up and joined the other members of her team at their table when I started to put the questions on the overhead. Another student from the class came up to sit with Dee at the front of the room. This student, Lee, another native Black female student, had a very generous nature, but she had recently experienced some trauma in her life. Her older brother was diagnosed with cancer while serving in Iraq and, after returning to the United States for treatment, died at the age of 19. I didn't know if the others in the class knew about Lee's brother. She had shared this information with me in a private moment. But after Lee came to talk to Dee, I saw Dee take a deep breath, and she walked back with Lee to join her group. "I don't want to be no recorder no more" she told me. As Dee walked back, I noticed how slow and deliberate she was in her movements. During previous lessons when she was upset, she used to walk out of the room. She never went far, only outside the door, and she needed to be coaxed to come back in. When I reviewed the tapes of this game as well as other lessons which I did not select to write about in this dissertation, Dee was always huddled over, and usually when she smiled she raised her eyes slowly to look at whoever was talking to her. She did not exhibit signs of synchrony or solidarity, yet when Lee came to speak to her she was in synchrony with her.

When Dee got to the lab table, she started copying someone's homework. She did this while leaning on the lab table. Then she started arguing with a Black male student at the next table. He turned away from her so as to stay out of trouble. Her quick temper showed as she yelled at him for allegedly looking at their whiteboard earlier. Her body movements and voice

characteristics such as pitch, loudness, and tempo were not indicative of synchrony or solidarity, but hostility. To try to quiet her down, I told the class "Guys, hide your boards."

The students were answering animatedly in very loud voices as they tried to answer the questions. I found that they were much louder than my voice, and I was afraid some of the class would not be able to hear me as I asked the questions. When I asked them to be quiet, my voice got loud, and Dee got upset. I didn't know if she was upset because she thought that the other student had been loud or because she felt that she had been told to be quiet. She left her lab station and went to sit at the side of the room. She wouldn't participate any more. After a few minutes, she started talking to a student near her but wouldn't participate in answering the questions. When the Black male student from the other table started to bother Dee by throwing paper in the sink near where she was sitting, Dee told him to stop. He did, and Dee just stood at the lab table not participating. Dee was not exhibiting mutually focused emotions or attention. There was no shared participation at this time. Neither did she exhibit solidarity with the class or show any signs of group membership.

Shared Reality Was Created

As I continued to view the videotape, I noticed that during this time Ebony was at her lab table. While her partners were working, she was examining the contents of her pocketbook. After a few minutes the others at her table convinced her to participate. She became the recorder and wrote the answers on the whiteboard and held them up. It was interesting to see how the others at the table got her to change her mind about participating. They approached her quietly. One student put her head down near the table and talked to Ebony while Ebony looked down at her. When I looked at the tapes I realized that Lee had joined this group as well and also was talking to Ebony. In retrospect it was unfortunate that Lee wasn't part of the cogen.

She had asked to be involved, but she had gym class when we met, and the teacher would not have excused her. When Ebony held up the whiteboard with the right answer and I said, "That's correct," Ebony's face lit up with a big smile. In this group, there had been an interaction in which the group created a moment of mutually focused emotion and attention in which there was a moment of shared reality. This success generated solidarity and symbols of group membership.

We met for a cogen after this study session, and I showed them the sections highlighting Dee's inactivity and Ebony's initial indifference. Dee said that she chose to stop participating because she was mad. She thought I was yelling at her. I explained that her behavior and not participating in class was not conducive to learning science. At the time I did not realize that she was just enacting her culture in the classroom and that I was enacting mine. Her feelings were important to her, and she was reacting to what she felt was an emotional cue. She misinterpreted my asking her to be quiet in a loud voice as my being angry at her. Other students might have reacted differently to me in that moment. We did not have a meeting of the minds about what was important in the lesson and how we could better understand each other. I told her that it seemed as if she was just interested in arguing and talking and was not learning any science during this activity. The other students were involved and enjoying themselves, and she was not being attentive. She didn't say anything. I also spoke with Ebony. She said she wasn't interested in the game, but when Lee and the other students asked her to take part, she agreed, and then she began to enjoy it. She was exhibiting solidarity with others. She had not felt any solidarity with me, and although I was learning about Black cultural ethos which encouraged the building of social relationships by permitting side talk, playfulness, and socializing of the type that integrates sociality into task completion, I really wasn't. In this first

year of my research I was still trying to have students act like they were part of the mainstream culture. Her behavior towards me and mine towards her were not in synchrony, and we did not understand each other. The lesson and the way we played the game were not culturally relevant to her.

What Students Leaned about Creating Solidarity

When we began the game again the following week, Dee was at the table, but from her facial expression and the way her body was oriented away from the front of the room it appeared that she was not really concentrating. She was tapping on the table. She was talking, but not about the questions being asked. Lee once again was at Dee's table. Dee did gaze at her and oriented her body towards Lee. Lee and Dee began talking to each other, and Lee got Dee to write down an answer on the whiteboard. Dee held up the whiteboard and the answer was correct! A smile lit up Dee's face, one of the few I had seen that year, and she was involved writing answers on the whiteboard and focusing her gaze towards the front of the room for the rest of the class. Lee again was able to guide Dee toward mutually focused emotion and attention, thereby producing a momentarily shared identity that helped to generate solidarity and a symbol of group membership for Dee and herself. Dee and Lee were acting in synchrony with each other to find the right answer and were pleased with their success.

Together Everyone Achieves More

The following week at the study challenge Dee again was reluctant to play the game. She said "I don't like playing the game." To make sure I heard her, she said it three times. I didn't reply. She sat on the table looking at her legs and sneakers. She talked to Lee. Even though there was a lot of noise, the students were able to answer the questions correctly. At one point a student was kicking the table next to Lee. Someone unfamiliar with my teaching

philosophy and the research I was doing who had walked into my room during the game would have thought that I had lost control of the class. The opposite was true. Not only were students learning science and teaching each other science in the process as they discussed answers before writing them on the whiteboard, they were smiling as they did it, gazing at each other, and from their body orientations, everyone was involved. I saw that most of the class was exhibiting synchrony, mutual focus, and solidarity.

Dee and Ebony had exhibited a lack of synchrony earlier when they chose not to participate. Students who were involved and who acted in synchrony were able to complete their laboratory worksheets successfully and earn good grades for the assignment. Because Dee and Ebony were part of a lab group, they were able to get a good grade once they began to participate. Lee worked with Dee and encouraged her to work answering the lab questions and the lab write-up. I explained to them during a cogen that had they not finally cooperated, they would not have gotten a passing grade on the lab. The fact that they were part of a group was not enough for them to get a passing grade; everyone had to be involved in the work of the lab to get a grade. Handing in a completed worksheet was not enough. Everyone needed to be involved in the experiment so they could develop a science identity. A small smile appeared on Dee's face but she didn't say anything. Ebony smiled broadly and said "Yes, Ms. Baker," From the way Ebony was turned away from me, and looking at Dee I got the feeling that she was just saying that, and that it didn't mean that she was going to be more involved next time. She was involved the next time, but she again had to be encouraged to participate.

Student Engagement

When I examined my results by viewing the videotapes, I found that interactions that showed evidence of student engagement such as eye gaze, overlapping speech, entrainment in

conversation, and shared action produced a collective sense of engagement which affected other students and brought them into the interaction. The students had expanded agency by getting the answers correct, and they were seeing that science learning is fun and that they could be successful as science learners and can acquire science identities. By studying the vignette, I was also able to gain a better understanding of the nature of engagement, the interaction between science lessons and student engagement, and how to study actively the relationship between the way I as a teacher and Dee and Ebony along with the other students engage during a science lesson and how that leads to learning. The goal was to reduce resistance and help expand agency.

While my students often helped each other and exhibited positive emotional energy, synchrony, mutual focus, and solidarity, negative energy and asynchronous behaviors also surfaced. When we looked at the videotape during the cogens we discussed the way that Dee had begun the lesson by sitting apart from the rest of the class at the front of the room. Some of the negative behavior and asynchronous actions was eventually transformed into positive emotional energy and synchrony. I observed this transformation as Ebony and Dee prepared for the 8th grade science exam by practicing the ramp and ball experiment, presented later in this chapter. In addition, a collective sense of engagement affected the other students and brought them into the preparation and performance of the experiment. Dee's lab partners helped her when she had difficulty with the lab activity. The learning process requires action; the interaction between science lessons and student engagement in my science classroom promoted knowledge. I looked at all of these concepts as I helped my students study for the 8th grade exam by doing the Efferdent lab. In this laboratory activity student groups grind up Efferdent tablets and expose them to various variables to test their solubility.

The Grade 8 Intermediate-Level Science Test

In my New York State school district students must take an exam at the end of the 8th grade in all of their academic subjects. Because the students are looped (they have the same academic teachers for both 7th and 8th grade), teachers have a better chance to prepare them for the tests they have to take, which cover materials they have studied from grades 5 through 8. In the sciences the exam is the New York State Grade 8 Intermediate-Level Science Test. The regulations of the Commissioner of Education of New York State require that this test serve as a basis for determining students' needs for academic intervention services in science (University of the State of New York, 2006).

Practicing for the Performance Test

The Efferdent/solubility lab was one way for the students to practice laboratory skills required for the hands-on performance section of the exam. Before we did the solubility lab, students needed to learn the difference between a solute and a solvent and to understand the concept of solubility. I began the lesson by making chocolate milk. I explained to the class that a solute dissolves in a solvent. There was mutual focus in the classroom as one student called out loud "What is a milkshake?" Before I got a chance to answer the question, other students called out answers. I did not answer their questions, but instead I did a demonstration in which I put salt in water to hold their interest. "Bam" I said. "Which is the solute? Which is the solvent?" I asked. There was synchrony as students smiled. While I was demonstrating this, Ebony was chewing gum and curling her hair. One student asked: "What about peanut butter and jelly?" One student said: "That's a good question." Another student: "There's no solvent and no water." I saw students putting their chins on their hands and beginning to write the notes from the board into their notebooks. Their interest was piqued. One student called out another question "Why doesn't oil dissolve in water?" She used her hands to mimic pouring oil. I had

demonstrated that oil and water don't mix in an earlier lesson. I explained that water molecules are polar--they have a small positive charge at one end and a small negative charge at the other end--and they stick to each other. Oil molecules are non-polar – they have no charge. Because of this, oil molecules are more attracted to each other than to water molecules, and water molecules are more attracted to each other than to oil molecules. The oil floats on top of the water because it is less dense (a spoonful of oil weighs less than a spoonful of water). As I explained, the students were looking at me with mutual focus; they were in synchrony, and, as I later saw on the videotape, solidarity was present in the classroom.

I asked the class to answer the following question as they did the lab. What affects solubility? I told them to consider looking at one of the following variables: change in temperature, change in shape, and the use of stirring. I suggested that they could think of another variable they wished to investigate. I was providing the structures for the lab, and the students needed to exercise their agency in order to work on the laboratory activity.

The students knew that they needed to determine variables that affected solubility. As the students went to their lab tables before they began, several of them were tapping on their desks. In my classroom environment there was high intensity and high variability. The students were talking in loud voices, and a variety of things were happening at the same time. These activities involved students who were sitting at tables observing an attention-getting demonstration (grinding up the Efferdent tablet) or involved students who were physically in motion (moving from station to station). In BCE theory movement may often accompany *verve*. Verve includes action that is energetic and active. In this lab activity students were able to walk around and observe what others were doing at the lab tables. They were able to come to the front of the room and get materials and equipment and bring it back to their lab tables.

From Asynchrony to Synchrony

As I gave instructions in preparation for the activity, Ebony was putting on lipstick. She looked up to see if I noticed her doing this and put her lipstick away when she saw me looking at her. When I asked for volunteers to help me, she volunteered to help demonstrate the lab. In a previous cogen we had discussed behaviors which were not aligned with learning science. I still was not comfortable with the dispositions that the students were displaying in my class. We had talked about putting on lipstick and combing hair in class. This behavior had nothing to do with cultural context of learning. Ebony remembered and exhibited a change from asynchrony (putting on lipstick) to synchrony (helping to demonstrate the lab activity).

The lab involved the solubility of Efferdent tablets under different conditions. From the front of the room, Ebony showed the class how to grind the tablets using the mortar and pestle. She was using her agency to appropriate the resources available to her, the resource being the Efferdent tablets and the mortar and pestle, and being in the front of the class was her way of using her agency.

The tablets were originally all the same size, but students could grind them to any size they chose, or could leave the tablets whole. Students were asked to change one variable at a time and see how long it took for the Efferdent tablet to dissolve. They could choose whichever variables they wanted to research. Their instructions were to write up the lab procedure they used, which variables they picked, do the experiment, complete the data and graph it, and hand in the completed lab for me to grade. Although they were allowed to work as a group, each student had to hand in an individual lab report.

After helping me with the demonstration at the front of the room, Ebony returned to work with her lab partner. The equipment was at the front of the room. Students came up to get Efferdent tablets, mortars and pestles, beakers, thermometers, and stopwatches. Water was

available at the sink that was at each lab table. At the front of the room on my large lab table, I had a hot plate with a kettle of hot water and a bucket of ice. I positioned myself at the table with the hot water, and when students came up with warm tap water, I added some hot water. They were able to take ice cubes on their own. Students were able to move around the room and talk to each other as they did. This ability was an important social and cultural experience for the Black students in my class, who used communalism as a cultural disposition and as a part of their regular practice. It also reduced resistance and helped students to define themselves as science learners as they discussed the terms of the experiment. My non-Black students seemed comfortable with the movement around the room, although they themselves did not move around as much, and, when they did move, they went back to their lab stations more quickly.

Dee and Lee as well as Ebony exhibited communalism, a value of BCE. They were committed to helping each other, and this connectedness was important for the social bonds that formed. Lee helped Dee become part of the experiment. She showed her that she had responsibilities which were of more importance than the individual privileges she felt she had in the classroom. Ebony created social and symbolic capital as she demonstrated the grinding of the Efferdent tablet at the front of the room. Seiler & Elmesky (2007) argue that communalism is common among Blacks and has particular significance in interactions among urban teens and the urban classrooms in which they learn. They believe that communality can bring about the generation of social and symbolic capital as well as positive emotional energy. In this way shared goals are enhanced as science participation, and the understanding of science principles are improved.

Engagement and Solidarity

Dee began the lab by getting the equipment from the front of the room. She was engaged with her partner. They worked together in solidarity. By carrying the lab materials to the lab table, animatedly talking and working with her lab partner, Dee exhibited sociality, verve, and movement. Dee and her lab partner smiled at each other, and Dee started to grind the Efferdent tablet with the mortar and pestle. They put the ground-up tablet into beakers of warm and cold water and put their heads down on the table so that they could better see the bubbles from the tablet. Other groups actively did the same thing and acted with synchrony, mutual focus, and solidarity. Students also held the beakers up to eye level to watch the effervescence. I noticed when I was watching the videotapes that Ebony left the table and came up to the camera with a big smile while the rest of her lab table was working. Without realizing that this also was one of the values of BCE--expressive individualism in which the individual shows a distinct personality and is prone to spontaneous and genuine personal expression--I thought to myself that she would have to be reminded in the next cogen that this type of behavior would not help her be successful in class. However, she immediately returned to the table and began working. When I asked her in a cogen later why she left the lab, Ebony told me that she was just getting another beaker, because their experiment had "messed up." I was still learning the cultural capital she was bringing into the classroom environment.

The Ramp and Ball

The Grade 8 Intermediate-Level Science Test has a section where students have to do three hands-on activities. One of the three stations on the Performance Test is the Ramp and Ball. My class practiced for this lab activity using cars and ramps. They were not allowed to use the same materials that appear on the test but could practice using similar types of materials and activities.

In this vignette as with other vignettes, I videotaped the students as they practiced the activity in order to understand their interactions, the extent to which these interactions became resources for creating a community of learners, and how these interactions contributed to a positive learning environment. I generally recorded two or three times a week, a half-hour at a time. I recorded cogen sessions as well as class activities. When laboratory activities or projects were involved, the recording sessions varied in length. The cogens and classes were recoded from various angles around the room due to the collaborative nature of the research and the fact that students were moving around during laboratory procedures. Sometimes a student videotaped instead of me. At times the camera was placed at the front or back of the room or on the tripod in order to videotape entire class interactions.

Mutual Focus Leads to Synchrony

The students needed to measure how far a car rolled down a ramp, which they did using a meter stick. About ten minutes after the ball-and-ramp activity began, Dee started talking to other students at her lab table. Dee and her lab partners exhibited mutual focus as they began to roll the car down the ramp.

I watched as Dee changed her behavior slowly from asynchrony to synchrony. A buildup of asynchronous practices can disrupt the fluid enactment of culture. Initially, Dee was not involved in the activity. While others worked at their tables, she alternately danced at her space and sat or stood quietly at her lab table. Dee had originally looked around at her partner and at the other two girls at her lab station. Dee remained seated as the others worked around her. She talked to the others but did not participate. Her lab partner explained what they were going to do. This was the beginning of synchrony. Dee began to talk to her lab partner; she patted her pocket for a pen, found one, and started to write down information to begin the write up of the lab activity. Dee wasn't shut down, and she exhibited sociality. She was involved in

social activity by having side conversations not related to the task at hand. The videotape still showed no synchrony. Dee was not being shut down, yet she wasn't attending to class.

As I watched the videotape I saw Dee and her partners exhibiting synchrony as well as interaction chains. Dee's eyes were on the paper. She talked quietly and moved her hand as if to push the car. Dee finally began to roll the car. It fell to the ground and a wheel fell off. The expression on her face showed that she seemed startled and embarrassed. Dee said, "Our car fell apart," and smiled again, still looking uncomfortable. There were four students at each lab station. They were partnered two-by-two. Her lab partner and the other two students at her station smiled also, just smiles denoting "that's ok." She found another wheel in the box and fixed the car. Her lab partner left her alone as she fixed the car but looked at her and smiled when she saw that the car was fixed. Because Dee was able to rebuild the car, she was pleased with herself. From then on she was involved in the activity. Her negative emotional energy, which may have been caused by boredom, changed as she appeared pleased by the positive responses she received from her lab partner and from the others at her lab table and me for being able to rebuild the car. She saw that we were not angry with her for dropping the car and causing the wheel to break. On the contrary, we were pleased with her because she was able to rebuild the car and resume the activity. She gained social and symbolic capital along with positive emotional energy.

In my classroom Dee was able to move from place to place to get equipment and she was not reprimanded for dropping the car. She exhibited verve and movement when she got involved in fixing the car and in being able to choose which equipment was necessary to fix the car. She had to multitask. This learning event also created opportunities for Dee and the rest of the class for gross, fine, and performance movements marked by a repetitive pattern.

The next day in a cogen as Dee and Ebony and I watched the videotapes, we discussed the importance of being a part of the lab activities not just on-lookers. I applauded them for becoming involved and becoming participants. They smiled, Ebony a broad smile and Dee a small smile I could see from the side of her face, as she didn't look me directly in the eye. As Dee and Ebony and I spoke to each other, I realized that I was still only beginning to understand the different cultures in my classroom. As these students spoke to each other, they seemed to be placing importance on their feelings, paying attention to each other's emotional cues and emotional expressions. As I was discussing the importance of being part of the lab activities, I still did not understand fully the importance of the dispositions Boykin (1986) attributed to African American students. This cultural difference is represented as a unique cultural ethos often in conflict with the culture of mainstream America and therefore with school as well. This unique way of interacting in the classroom reinforces the difficulty teachers and students have understanding each others' cultures. I was trying to improve my classroom learning environment and was doing research toward this goal, but I was nevertheless misunderstanding my students' behaviors. I did not understand that, although there is a great variability among Blacks as a group, BCE, a derivation of West African beliefs, values, and traditions, is a way that Blacks interpret, perceive, and interact with the world.

When Dee and Ebony were in cogens, Dee was often humming and often tried to listen to her ipod and danced in a small space while we were talking. I encouraged her to talk without the ipod so that we could listen to each other, and told her that in class she should not use the ipod either. Movement and interweaving rhythm with music and dance in everyday life is one of the dimensions of BCE. Had I realized this, I could have used cultural reference points like music to facilitate knowledge.

During cogenerative dialogues I began to understand the different cultures in my classroom. I began to understand that Dee and Ebony performed lab experiments with more interest as well as performing more tasks correctly when they found that the instruction was relevant to them. When Dee and Ebony had the opportunity to talk about their lives in a cogen, I found out that Ebony is of Jamaican ethnicity. Previously I had no idea of her ethnicity. After learning about West Indian immigration and the desire of Jamaicans to succeed in school, I was also surprised that Ebony did not seem to feel that succeeding academically was of that much importance to her. She mentioned in a cogen that she wanted to succeed, but her teachers did not understand her. I noticed that Ebony cultivated a distinctive personality and enjoyed spontaneous, personal expression. This is one of the dimensions Boykin (1986) articulated. This type of acting in the classroom challenged me as a teacher. It was evident when Ebony came up to the camera during an experiment and looked right into it as she said hello. The other students in the class worked on their lab activities. Only Ebony came up to the camera spontaneously. I feel that in this first year of my study. Dee and Ebony were able to access their agency and become more confident in their science knowledge in my class as a result of participating in cogenerative dialogues. Just meeting with me as the teacher helped them to act independently in class as well as be involved in shared responsibility, as it would have for most students. But I feel that it was important for Ebony to see me as a person and not just as her teacher. I explained to Ebony that I was slow to see the capital she was bringing into class. She became more involved in the class after that.

As we were doing a lab, Ebony talked animatedly with the others as they discussed the results of the laboratory procedure. Later in the day in a cogen she revealed that she had earned a certificate for good grades. She had made the Honor Roll. She had not told me this before,

but I had seen her earlier at a breakfast that the principal gave for students who made the Honor Roll. I announced to the class that Ebony had received the certificate for good grades and told the class that I hoped to see more of them at the breakfast the next quarter. Ebony smiled a broad smile and continued with the lab without missing a beat. Ebony took a stopwatch, setting it to the starting point and began to time the descent of the car. She was engaged with her lab partner. I noticed that Dee also smiled when I made the announcement about Ebony's certificate. It was a big smile. Her smile seemed to indicate she was pleased for Ebony.

In the next chapter I present some vignettes with students from the second year of my study and the part that cogenerative dialogues played in the teaching and learning of science that year.

Chapter 6

Emotions and Cogenerative Dialogues

In this chapter I look at research I did on cogenerative dialogues with five students from one of my science classes. Cogenerative dialogues allowed for expanded agency, the creation of new goals, and an increased interest in success. Recent work has expanded the identification of semiotic resources, including structures in the setting and body orientations (Roth, 2005). Emotions are the key to increasing sociality and bonding. Roth (2005) found that the micro and macro levels of society can be integrated when event in a classroom are seen as a whole. Emotions are part of this orientation, as the conscious goals they pursue, and the ways that these unconscious operations meet these goals.

Roth (2007) argued that it has been well established that, in addition to its linguistic content, the speech signal carries information about the speaker's intentions and his or her emotional state. Listeners, he maintains, are capable of perceiving this information without having to stop and reflect upon it. It has been suggested that during conversations participants become aligned in speech and in prosodic features. Theorists in the sociology of emotions, such as Collins (2004), suggest that emotions are articulated and are therefore communicated by prosodic and other observable means, constituting the essential glue that binds individuals in a collective. In cogens we discussed an episode that dealt with the filling out Punnett squares in a vignette that follows. A Punnett square is used to find the genes of the next generation. On the outside of the square, genes for the parents are placed on the sides and top of the square, and the genes are then placed on the inside of the square, a vignette which follows. In this interchange some of the students brought up the way they and their peers felt about the control some teachers exercised over the students. As students conversed, I *saw* rhythmic patterns of gestures, rocking movements of legs, head movements, and stressed syllables, produced and reproduced in

synchrony by students in cogens as well as the classroom. I also saw similar patterns of gestures, head movements, and stressed syllables produced and reproduced in synchrony by students during lab experiments like the ramp and ball as well as the Efferdent lab, as I moved from one lab station to another and held small face to face conversations with students at lab stations around the room.

Learning is a social activity in which interaction with others is essential for students in order for them to participate in the language and practices of particular communities or disciplines (Lave & Wenger, 1991). Interaction within social settings is particularly important for learning science, as science is a discursive activity involving the collective use of science-related terms, methods, and argumentation in order to construct concepts or thematic patterns (Lemke, 1990) and in order to evaluate explanations of phenomena. In cogenerative dialogues I looked for ways to listen to students, to help them expand their agency, and to improve the emotional climate of the classroom. I recognize that in many schools there are often power imbalances, as students exercise little or no power compared to the teachers or administrators. These power imbalances are present in the field of the classroom and in other fields of the school as well. In the case of a cogen, power is in the ability to have students themselves ask to convene a cogen and to decide whether or not to incorporate some cogenerated ideas into the classroom. Many teachers feel that they need to establish control over students by managing their misbehavior, keeping them orderly, and maintaining relatively quiet classes. This diminishes the success of interactions. Teachers seem to have difficulty in identifying the capital that urban youth can use as a foundation for learning science (Tobin et al., 2005). In her research Sonya Nieto (2002) suggested that students experience a sense of exclusion because of cultural differences. This exclusion is based on the cultural differences between urban minority youth and their teachers,

many of whom are not of the same culture or class. Many teachers use teaching practices that are not adaptive to the cultural and social capital of their students (Nieto, 2002). Under such circumstances students do not produce the success that might otherwise be possible if educators appropriated teacher's practices that were adaptive to the needs of their students.

An Encounter with a Teacher Leads to Conflict

Torie, a member of the cogen I held in the 2nd year of my study, came to a cogen after an encounter with a teacher in the science department that left her feeling very disheartened. I believe that this teacher was reacting to Torie, who is a native Black female student, because he saw her from a deficit perspective. Torie, although not a student in my science class, joined us in cogens because of her friendship with Karen, who was a member of my class. The episode occurred before the school day began. Students were passing through the halls to their classes, but the bell had not yet rung for class to begin. The teacher was standing outside his room at the beginning of the day. His students were filing into class. The classroom was next door to mine. I had already entered my room getting my camera ready. Torie tried to enter the classroom of the teacher next door to say hello to a friend. She had seen this friend enter the class, and she tried to walk into the classroom. As she did, she was laughing loudly and the teacher told her to leave. She was showing verve, showing a preference for intense stimulation and action which was energetic and active. She was told by the teacher that her behavior was inappropriate and disruptive. She told the teacher she was just trying to talk to her friend, but the teacher told her that she was being argumentative and again told her to leave or he would write her up and have her speak with the assistant principal. She tried to explain to the teacher that she only wanted to say good morning to her friend, but he wouldn't let her into the classroom, and he wrote her up. This teacher obviously did not incorporate or understand BCE. According to Parsons (2008), the

BCE aspect of verve shows a preference for high physical stimulation. Verve encompasses actions that are energetic, active, and colorful. This stimulation consists of two components: intensity and variability (Boykin & Allen, 1999). High intensity and high variability can lead to loud noise levels. Torie was exhibiting verve. In the hallways of my school, often Black students greeted each other in loud voices and their voices were not toned down when they entered the classrooms. They were comfortable with the dimensions of sociality and verve. The teacher at the doorway of the classroom was not. To defuse the situation the teacher could have quietly told Torie that he didn't want students to enter his class if they were not in the class. He had the right to manage his classroom and his own cultural capital, but he could have spoken to her in a different tone. After the incident mentioned above, Torie came into my classroom crying loudly, and it took a few minutes for her to calm down. Her pitch was high, and her voice was loud. Instead of explaining the situation, she called the teacher an "asshole." I asked her what was wrong, and all she kept saying that the teacher was a "racist asshole." Her volume started to decrease when I finally got her to calm down and go to her own class. I told her that if she came to the cogen later that day we would discuss the situation. Had Torie and the teacher with whom she had the conflict been able to repair the breach in their relationship the negative energy that was created might have changed over time to positive energy. However, the teacher was not involved in trying to understand BCE, so the opportunity for repair did not present itself. Had he and Torie had a discussion, the opportunity for repair might also have been a possibility.

Keeping Control

Before she left for class, Torie told me her perspective on what had happened. Before my class began, and after Torie had left to go to her class, I went to the teacher who was involved in the incident and asked him what had occurred; he didn't even remember, though the incident had

just occurred a few minutes ago. He was a young, White male teacher, and he felt that keeping control at all times gave him the best results.

The teacher stood in front of his room during passing time between classes. This teacher knew of my research, but I never felt he was listening when I talked. When we were at science department meetings, he never voiced his opposition to my research, but it was evident from his behavior that he was not in agreement with me in recognizing the importance of understanding the ways in which different cultures interacted in the fields in the school. He did not disagree with me to my face, but I knew how he felt, and he made this evident when Torie tried to enter his class. He didn't know she was a participant in my cogen because she wasn't in my science class. If he had known, perhaps he would not have acted as he did, but interacting with Torie in that way caused her to label him a "racist asshole" who didn't acknowledge her right to see a friend before the school day started. He in turn saw her as a disruptive student who was disrespectful to him.

Speaking to the Teacher

I did speak to him and let him know that Torie was part of my cogen. He apologized and said if he had known that she was in my cogen he would not have treated her in that manner. I asked myself why that should make a difference. His body movements and his voice characteristics such as a low pitch register made me think that if he has known she was part of my cogen he would not have acted towards her in the same way. He moved toward me as he spoke, and used a low tone of voice. I did not want to start an altercation, so I just smiled. He told me he would not send in the referral (write-up) to the assistant principal. Looking back on the situation I see that this was a good teaching moment, one during which I could have interacted with the teacher and explained to him the research of Boykin, Parsons, and others, but

I did not take advantage of it at that time. I did discuss these researchers in common planning at science department meetings, but I don't think this teacher was listening to the ideas. He never became involved in the conversations we had.

When Torie came to the cogen several hours later at our regular scheduled lunchtime meeting, she was still upset and angry. Not everyone in the cogen had knowledge of what had transpired. Karen knew because when Torie came into my room earlier to tell me what had happened, Karen overheard and was upset as well. Torie had an in-your-face attitude, and usually it was seen as assertive and not disrespectful. She believed she had been misunderstood by this teacher. Torie was an athlete in our school, her sister was in advanced science and math classes, and she did not want to get in any kind of trouble. She had been suspended previously for talking back to a teacher. Her sister was quiet and kept to herself; Torie's in-your-face attitude was a way to balance her desire to be more like her sister and get good grades and her desire to be accepted by her peers. In this case, her attitude had become a problem for her. Her loudness and tempo were seen negatively by the teacher. Torie believed that her speaking pattern had been misinterpreted.

As Torie continued to explain in the cogen what had occurred, Karen wanted to know what was "wrong with that teacher." The pitch, range, and loudness of Karen's voice were indicative of synchrony and solidarity with Torie. "All Torie wanted to do was say hello to Tyrone." As the other girls heard the story from Torie in the cogen, they all felt that the teacher was wrong. Their voice characteristics also indicated synchrony and solidarity with Torie. When the incident occurred, class had not yet begun. They felt that Torie should have been allowed in the classroom. I tried to explain that the teacher was trying to maintain the control he had, and that if he had let Torie come in as she had tried to do, loudly, and without asking, he would have

felt that his control was diminished. The girls didn't buy it, and, neither did I, but it gave them another point of view. I was sugarcoating the incident rather than addressing it with my students. I was not dealing with what the teacher was saying because I was still uncomfortable with criticizing other teachers even though I knew that their approach would not necessarily result in the best outcome for this particular subset of students. I was also still uncomfortable with a discussion about racialization with my students. I did ask Torie why she called him a "racist asshole." Her response was that she saw him talking quietly to the White students in the class, but when he asked her to leave he was loud, and she felt that he disrespected her and treated her differently because she is Black.

Treating Students Differently

I asked the students if they thought that some teachers treated them differently because they were Black or White. Their responses were interesting and depended on their ethnicity and cultural background. Karen, who is Black and Jamaican, felt that the teachers should understand that Torie was not being disrespectful, that this was just the way she talked. She expected the teachers to know what her culture was and was surprised that this teacher had acted in this way. Beautiful, an American Black student was initially quiet but eventually stated her opinion. She felt that some teachers in the school were racist, whether they realized they were being so or not. She believed some students were treated differently from others. She wasn't able to articulate (or didn't choose to articulate) why she felt this way, but her gestures of pointing her finger in the air and thrusting her body forward as she spoke about being treated differently showed how uncomfortable she felt about being treated differently. Beautiful felt that she had experienced this differential treatment at times in this school as well as in her previous school and in the community. When Beautiful spoke, I noticed her head nodding and her body movements

supporting her statements. Beautiful spoke with what might be interpreted as a defiant attitude as well but not in front of teachers. She saved this way of talking for her peers as a way to fit in. When she spoke to them, she was loud. Her tempo and the duration of her syllables indicated that she was in solidarity with them.

In a cogen we discussed how some of the teachers to whom Beautiful was referring to were committing symbolic violence. I did not bring up the term symbolic violence in the cogen, and I did not speak to these teachers directly about Beautiful, but it seems that these teachers were viewing Beautiful from a deficit perspective. Listening to Beautiful and the others in the cogen expressing their dissatisfaction with the way they were treated suggested a mismatch between the school's norms and values and the homes and communities of ethnic minorities. I needed to incorporate others' cultures into my lessons, including face-to-face transactions. Not doing so was interfering with students' ability to learn. I tried to familiarize myself more with what culturally adaptive learning would be.

In this same cogen Krystal, a White Hispanic without an accent, told us that she had not been a victim of symbolic violence. She felt that teachers treated her respectfully. She was an excellent, hard-working student and did not have what a teacher who was used to taking control might consider a defiant attitude. Beautiful mentioned that perhaps that was one of the reasons that Krystal had no friends in the school other than Beautiful. Beautiful thought that the other Black students thought Krystal was too quiet and that she sought to be in the background rather than be visible. Krystal was new to our district, and I hadn't noticed her with any other Hispanic or White girls, only Beautiful and her Black friends. As discussed in an earlier chapter, Krystal had to go home after school to take care of her younger siblings.

When the bell rang, the students left the cogen. I planned to bring this question up again at another time. One question entered my mind, however: How forthcoming would these students be with their comments to me, a White teacher, had we not been in having conversation in cogens? They had been anxious to talk that day because of the incident with the other teacher, but would they be so forthcoming with their comments if that incident had occurred and we had not been having conversations? If we had not been having face-to-face conversations in class, would these students have been comfortable enough to call teachers in our school racist and then try to understand why that might be so or why the students viewed the teachers in that particular way?

Because dialogue is a key feature of cogen, the flow of talk is a marker of successful interactions. When the flow is working at its best, one person's actions are anticipated by others and become resources for their participation. In other words, one person's actions expand others' opportunities to act (i.e., agency). When these actions are anticipated, appropriate, and occur in a timely manner, there is a continuous flow of culture that involves the participants. In my cogen everyone did not speak at the same time; however, participants did act in synchrony by listening attentively, gesturing, moving their bodies, and engaging in self-talk, as the spoken (and heard) dialogue evolved.

The Synchrony of the Cogen

This was the case during the cogen session that I just described when students discussed the symbolic violence that Torie felt she had experienced. Although not able to articulate it, she felt that she was seen through a lens in which her capital was treated as a deficit. Torie was gesturing and moving her body as she called the teacher "a racist asshole." The others listened attentively and moved their bodies closer in to each other as if to give comfort to one another. They anticipated remarks from the others in the cogen. Beautiful moved her body toward the

group and gestured with her finger while she talked to Krystal, “Maybe that’s why you don’t have no friends but me, Krystal.” Karen stood up when she told the group that “that teacher didn’t need to act like that.” There was a continuous flow of talk as the students’ thought processes continued. As Beautiful was pursing her lips, I could almost see her recalling incidents of the past in which she felt that she had been subjected to symbolic violence or had been treated as if from a deficit perspective. I asked her what she was thinking, and she just said that she didn’t remember exactly. Then she said that what she noticed and hated most was when she went shopping and White storeowners or workers would follow her around as she shopped but didn’t seem to follow the White customers in the store. It was so obvious to her that she was being treated differently.

When Beautiful spoke, she stood up and gestured with her head as if she were telling the shopkeepers of her distaste; she talked loudly about the way she felt the storeowners treated her. “Why do they follow me around the store, just looking at me?” she asked, while standing up and pointing to no one in particular with her finger. “I’m not going to take anything from them.” Her indignation was apparent in the way she pursed her lips and grimaced. In this cogen the participants acted in synchrony by listening attentively, gesturing, moving their bodies, and engaging in self-talk, as the dialogue evolved. They took turns discussing incidents and helped build their social and symbolic capital. I, as their teacher, began to understand their cultural capital better.

Coteaching within the Cogen

A change occurred in the classroom as a result of the cogens, I believe. Cogen participants began to coteach in a variety of ways, assisting peers to learn when they needed help. In the second year of the study during one of the cogens, we discussed a genetics lesson from the previous day. The lesson had been on how to fill in the genetic relationships of parents

and children in a Punnett square. In this vignette the participants created positive emotional energy, helping Beautiful become more comfortable with science.

The girls in each year of the cogen changed over the year that I conducted the research. In this second year of the study, Beautiful began to understand that she was capable of doing well academically. She could understand concepts. Krystal became more vocal and willing to share her knowledge with others. Shantelle came out of her shell and interacted with others in the cogen and in the class as well. Karen became a leader and went on to be a leader in the 9th grade and at the high school. Torie began to understand that many teachers would not understand her culture and that, just as she wanted them to adapt to her ways, they wanted her to adapt to their ways.

At a cogen we were practicing Punnett squares. Beautiful was unsure of the way in which the genes were to be placed outside the square, but she thought she understood how to place the genes on the inside of the square. Karen called her up to the whiteboard and told her to draw the square, which she did. She leaned over, grabbed a marker, and asked Beautiful which trait she wanted to draw. Karen wanted to repeat the square we had done about brown eyes. I asked the girls the following question. "What is heterozygous?" Both Karen and Beautiful were at the whiteboard. Karen was on the left hand side and Beautiful on the right hand side.

I noticed for the first time that Karen is a lefty. She wrote Bb on the board. Beautiful said "I know, I'll write it." Beautiful wrote Bb on the board also. She looked at Karen's answer and asked me "Is that right, Ms. Baker?" She pointed to her answer. "That's heterozygous, right?" "Yes," I said. "One of each. Yes, that's right." "I told you," said Beautiful. "If B is brown, and b is blue, and the father has brown eyes, can any of the children have blue eyes?" I asked. "Draw Punnett squares and show any possible crosses that would give a child with that father blue eyes"

were my instructions to them. While Karen and Beautiful were at the whiteboard, the other girls in the cogen were sitting at their desks just watching.

As Karen and Beautiful started to write down the possible crosses on the Punnett square, I noticed that Karen stayed at the board the entire time while Beautiful wrote on the board a little, walked away from the board, and got some food, her lips smacking as she went back to the board. She smiled and said to Karen "I'm sick of you." She started singing. I couldn't understand what she was singing. Karen looked at Beautiful and laughed, but kept focused on her work. I asked her why she said that Karen made her sick. She said that Karen was always right. The different ethnicities of the students in the cogen were associated with their level of science learning. In this case Karen's ability to focus helped her gain a reputation among the others as always knowing the right answer. As I discussed in Chapter 3 of this dissertation, Karen's Jamaican ethnicity provided her with extra tools and with confidence in her ability to succeed in class.

As Beautiful tried to do the crosses at the board in the Punnett square, she came up with incorrect answers, and, when I told her she was wrong, she responded by erasing her answers and saying "I'm so stupid." She tried again, but then decided that she didn't want to do the cross. Torie had been sitting on my desk and watching Karen and Beautiful as they worked at the board. She came up to Beautiful and put her hand on Beautiful's hand—the one in which Beautiful held the marker. With her hand over Beautiful's hand, Torie used her own hand to write the crosses in the square. Beautiful erased what Torie had written. She said that Torie's work was sloppy, and rewrote what Torie had written. Beautiful started to sing again and pretended she was going to hit Torie with the eraser. Torie smiled. She was very animated, talking loudly. "Let's see what you wrote." She looked at what Beautiful had written in the

square. “Is that correct, Ms. Baker?” she asked me. “Yes it is.” Torie erased the board and called Beautiful “a genius.” Beautiful smiled and was happy. She walked away from the board with a broad smile on her face. Torie had facilitated an interaction in which there was a mechanism for mutually focused emotion and attention. She created a moment of shared reality as well as solidarity and symbols of group membership. Torie and Beautiful worked together for the greater good. Beautiful left the room to go to the bathroom. Torie started writing on the board. Karen had been working on crosses the entire time. The bell rang and the students left the cogen.

In cogens and selected vignettes my students demonstrated interactions that took place which allowed for the exercise of their agency and several of the constructs that Wade Boykin (1986) described. His framework of African American culture had nine dimensions: spirituality, affect, harmony, orality, social perspective of time, expressive individualism, verve, communalism, and rhythmic-movement expressiveness. Sociality is the central idea behind the social perspective of the time dimension. Time becomes significant when it is used to establish and nurture relationships that are emotionally rich. This idea of a Black cultural ethos came about in the late 1960s, when theories positioned low achievement of minorities in a discourse of cultural deficiency rather than cultural difference. BCE is a derivation of West African beliefs, values, and traditions and, even with the great variability of Blacks as a group, characterizes the way Blacks perceive, interpret, and interact with the world. Eileen Carlton Parsons (2008) found that the science achievement of African American students was positively affected when educators used culturally relevant instruction. The human interactions and the maintenance of the emerging social relationships that are core to sociality often involve verve and movement. Verve, movement, and solidarity are important, and they were evident in this vignette. As Karen, Torie, and beautiful were practicing the Punnett square crosses they were working with verve,

movement, and solidarity. Verve is present when there are actions which are energetic and active. There was intense one-on-one stimulation verbally as well as physically, as Torie encouraged Beautiful by moving her hand. Her actions and the language between Torie, Karen, and Beautiful were energetic, active, and colorful. These students showed solidarity as they worked together to help Beautiful succeed. They expanded their agency as they helped her access hers. This also was an illustration of one of Boykin's nine dimensions--that of communalism. That dimension demonstrates the commitment and interdependence of people to a connectedness that values social bonds and responsibilities. Karen and Torie worked together to help Beautiful.

Analyses of what happens in classrooms provide rich descriptions of class culture in terms of patterns of coherence and their associated contradictions. The previous episode regarding the Punnett square illustrates this clearly. Participants in the cogen reached agreements that reflected different perspectives among the members, and in so doing they built understandings about others' ontologies. As Karen and Beautiful worked on genetics problems on the board, they realized that their ways of accomplishing the solution to the problem differed from one another. Karen was focused, and Beautiful was often distracted. The understanding of each others' ontologies is important in the teaching and learning of science. Beautiful began to understand that Karen worked hard to get the right answers and Karen began to understand that Beautiful wanted to get the right answers, too.

Respect Begets Respect

Karen, a member of the cogen, wanted respect from all participants, White, Black, and Hispanic. She also showed respect for all. Karen wanted to be accepted for who she was and for what she accomplished academically. She was an excellent student and was proud of it. Occasionally, others were jealous of her ability to focus and of her motivated attitude, but they

respected her. In one instance during a cogen session, the students decided to practice making crosses with Punnett squares. Beautiful and Karen were at the whiteboard. Beautiful was at the left side of the board and Karen was at the right side as they were practicing the crosses. Karen placed the genes for the parents (BB for brown eyes and bb for blue eyes) in the proper place on the top and the sides of the Punnett square. Beautiful kept changing the letters she was using for the parents. I looked at Karen's results, and they were correct. I told her so. Beautiful remarked "You're always right" as she continued to struggle with her choice of letters for the parents in the cross. It wasn't an expression of anger or frustration. She said it with a smile, and she looked at Karen's results and placed the same results outside and inside her Punnett square. There was mutual focus and synchrony was possible because respect was inherent in the interactions among these two students. Karen served as a coteacher in this cogen.

When co-respect occurs among participants there is a greater chance that successful encounters will occur. In the first Punnett square vignette Torie showed respect for Beautiful so that, although Beautiful felt uncomfortable not knowing the answers, she was willing to accept the help that Torie offered her even though she acted as if she didn't want the help. Later, when she was working on Punnett squares at the board with Karen, she approached the whiteboard after Karen had already begun working on the crosses, but as they began working at the board, albeit separately, a shared, positive mood ensued. This in turn led to a series of successful encounters that included signs of enjoyment and affiliation among the girls. This was also true earlier when Torie was helping Beautiful.

In the cogens Karen was usually a leader in initiating positive emotional energy. She always had a smile on her face and was a motivated student. Now, however, in addition she often raised her hand first to answer a question, and, if a student in the class did not understand what

was needed in a lab activity, she would explain it to them rather than just knowing the answer herself. This excellent and focused student became comfortable being a leader in class. At the end of the year she applied to and joined the Junior National Honor Society. Karen saw that others thought she was capable, and she therefore began to believe that she was capable as well. Participating in class and having success in the classroom produced changes in Karen's identity. These changes were conducive to her future participation in an advanced science class. Although she wanted success because her mother expected it of her, now she felt that she would be successful in science. Students respected Karen's ability to focus and to get the answers right through hard work and study. Karen was one of the students who went on to accelerated science classes at our high school.

One of the chief motives of cogens is to create solidarity. This solidarity must include a respect for difference and a willingness to learn from others as long as an individual's actions also contribute to reaching the group's goals successfully. Participants need to respect each other. Participants were asked not to act in ways that would prevent others from pursuing their goals. It is important that, if the goals and associated practices of a small group of others inhibit individual and collective goals, participants need to discuss these potentially harmful goals and practices and find ways to diminish or eliminate them.

Very often students talk about events or discuss conversations that have taken place in other school fields. The discussions can involve careful evaluation, interpretation, and discussion of events that students or the teacher feel need to be discussed. Shared experiences within the classroom and the practices and roles of participants are all open for discussion. For example, as students conducted a laboratory activity in the class they were also talking with their friends and their future plans, as well as what happened earlier in the day, in other classes, or on the bus

when they came to school. Because fields are porous, what happens in the field of the classroom can be affected by what happened outside the classroom, and teachers need to understand how these fields intersect in order to look for ways to improve the quality of teaching and learning. Students need to be allowed to share their experiences from other fields and not be asked to focus only on the lab activity. Insights come from shared experiences.

Students from the cogen at times took leadership roles in class in terms of discipline. When the class became too noisy, talking to each other rather than listening to the lesson, it was often a student from the cogen who reminded peers to quiet down. Karen frequently played that role in my class. She regularly told the class that they were being disrespectful and to "keep it down." To a lesser degree, Beautiful also used her voice to keep the class flowing smoothly when talk got too loud. She was often more aggressive in her expressions than Karen, but the result was similar. Beautiful told the students "to shut their mouths". Rather than ignoring Karen or Beautiful, students respected them both and reacted positively to them by toning down their voices.

The students in the cogen exhibited expanded agency as they accessed resources and were able to use their own resources to complete the genetics cross activities successfully. As I explored social life in my classroom, I also catalyzed social transformations as Beautiful, Torie, and Karen worked together. These transformations came in the form of Beautiful's beginning to understand that she could be successful academically. Karen began to understand that what her mother had told her was true--hard work and attention to studies does pay off. Torie started to understand that, although performing tasks was easier if they were culturally relevant, this would not always be the situation she finds in school. Torie and Karen were helping Beautiful because they were encouraged to use instruction that was culturally relevant. This helped her achieve and

become comfortable with her ability to anchor her knowledge of Punnett squares and to understand the concept better. The culturally relevant perspective helped Beautiful to achieve her goal of understanding the ways by which crosses are made. Krystal learned that it was important to be connected to others and that social bonds were important. Shantelle became comfortable in social situations.

In many school districts, when parents are unable to act as advocates, students can often be disadvantaged. However, in our school district the science department, the math department and the administrators did seek to act in the best interest of the student population once they recognized that the problems that existed. In order for students to enter the advanced science classes at our junior high school they had to take the pre-algebra exam and get a score of 90 or above on it. That was the initial criterion. During joint meetings with the science and math departments, the faculty discussed the low number of marginalized students who were able to get this score. We also agreed that algebra was not really required for students to succeed in earth science, which was the advanced science class the school offered. The math department agreed to lower the score that was benchmark, and the science department agreed. The administration also agreed to change the criterion so that more marginalized students could be included in the advanced science classes. The administration hired an a new teacher to teach the additional students that now were enrolled in the advanced science classes, and classes had to be added to accommodate all the students who now had a chance to participate. Science teachers were open to the idea of having students who might previously have been excluded from these classes now become a part of them.

Practices can contain emotions which can structure activity that occurs at a later time. My classroom provided a structure for interactions where all students had the chance to gain

resources for further conversations, and these interactions provided the potential for improving science teaching and learning in my classroom. The students in the cogen became leaders when it came to volunteering to answer questions and to participate in laboratory activities. Students who were at lab tables with the girls in the cogen were more involved in the activities, because they knew that the girls in the cogen would be working diligently on the labs. Students in the cogen exercised their agency and encouraged others in the class to do so as well. Karen became a leader not only in class, but in fields outside the classroom as she joined the Junior Honor Society and encouraged others to become members as well. Beautiful became more comfortable in her knowledge of science and rather than wait for others to do the lab while she watched them. Krystal also exhibited increased agency. She participated in lessons by answering questions and her test scores improved dramatically. She no longer sat quietly, but talked with others in her lab group. She engaged them in conversations and with direct eye contact. Shantelle also engaged others in conversation and with direct eye contact. She was a part of the interaction. However, Shantelle is an example of someone for whom the cogen did not work. She was not willing to share her experiences and always sat in the background during the cogen. We never got to know what she thought. She did not go on to the advanced classes.

Chapter 7

The Road Taken, the Road Ahead

Where the Study Was Situated and What I Did

In this research I took into account the history that shapes present and future practices. I also looked at the complexity of teacher and student roles, which are made up of practices and schema enacted with and without conscious awareness (Tobin, 2006). Using critical ethnography and microanalytic approaches to study the teaching and learning of science (Roth, 2005) in addition to the usual observational, methodological, and theoretical field notes, I videotaped and audiotaped lessons and had one-on-one and group discussions with students and teachers. On the micro-, meso-, and macroscopic level, I examined how participants' actions transformed the structures found within school and the classroom. I changed marginalized students' capacities, individually and collectively, so that they could act in ways that allowed them to experience expanded agency. I looked for evidence of increased rhythm, verbal fluency, and high energy in these students as markers of their expanded agency. My study shows, as Elmesky (2005) reported, that embodied practices enable connections with students that allow them to expand their capacity for action in multiple spaces.

Achieving Parity in Science Classrooms

I found ways to achieve parity in my classroom in terms of success in science by encouraging Black female students both in my classroom and in other classrooms to continue their science education in the upper grades. Their participation and achievement in science became the focus of this interpretive, sociocultural study that included theoretical frameworks related to collaborative research, autobiographical reflection, the sociology of emotions, immigration, racialization, ethnicity, and cogens. My class was mixed in achievement. I had some students who performed very well and others who performed badly, but my comparisons

were based on comparing my students to indices that measured achievement in Black students as well as all students as a whole.

In my two-year study of successful and unsuccessful interactions I examined dialogue, body language, gaze direction, rhythm of speaking, gestures, and synchrony or asynchrony in movements and expressions. I found that after participating in cogens students were more willing participants in laboratory and classroom activities. They spoke more often in class and answered questions more frequently and with greater confidence. Their body language and gaze indicated that they had gained confidence and had expanded their agency. These students moved towards each other as they spoke and worked, and their gaze with associated gestures illustrated mutual focus. They evinced synchrony, for example, as they worked together for a mutual goal of completing an activity like the solubility lab or discussing how to complete a Punnett square in a cogen. Asynchrony turned into synchrony in the ramp and ball experiment as Dee's partners helped her expand her agency and complete the lab. Contradictions arose in my reluctance to discuss another teacher's interactions with Torie, a member of the cogen, as well as in the way that, as my research progressed and as discussions at science department meetings continued, the teachers of the advanced science classes championed the changes made to the acceptance policy for marginalized students entering these classes. The teachers who would be involved in teaching these students were more eager to have them a part of their class than were the other teachers who would only be involved in choosing which of their students would be nominated to be included in these classes. These teachers were very experienced and had been teaching the advanced classes for several years. They looked forward to taking on a new challenge. During these meetings I explained some of the research about the cultural mismatch between many marginalized students in terms of their home and community culture and the culture of the

school. We discussed the theories around deficit perspectives in relation to marginalized students and how today we see that cultural differences may be responsible for the differences in achievement. We discussed BCE as an approach that characterizes the way Blacks perceive and interact with the world. Our conversations also broached the possibility that, if we understood the way these students interpret their world, we could alter the structures that are available and expand the agency of all participants involved. My students accessed and made use of the resources of a field such as my science classroom to gain agency and to transform my teaching style.

Students create and use capital through passive and active participation in their lifeworlds. Understanding how to align cultures leads to more successful interactions in the classroom. As we tried to align our cultures, students in the cogen were able to use their capital to further their science knowledge and expand their agency..

Common Planning Time Was the Transformative Charm

Implications for School District Policy and School Leadership

During common planning, when teachers got together to discuss topics of importance to the science department, I also discussed and explained the idea of cogens. We discussed how we could help our students develop resources that could be agentic. We discussed the idea of sharing our lifeworlds with our students. There was some resistance among the faculty to the idea of sharing experiences with students. In addition, many teachers in the department were accustomed to a style of teaching in which they were in control. They were not comfortable with the idea of students forming social relationships in their classes or with trying to understand students or have students understand teachers. Not all of the teachers took part in the discussions. The ones that were not interested did not contribute to the conversation. They only listened. I sometimes saw the teachers shake their heads side-to-side as if they did not agree, but I did not address their

gestures. Despite the reservations of some teachers, my chairperson allowed our discussions to continue for several sessions during the common planning time. I took the lead in explaining how cogens could encourage more students to become involved in the process of learning, and it was through these discussions that the science faculty became aware of the disproportionately small number of minority students in the advanced science classes. This was brought into the conversation by teachers who were actually involved in the teaching of the advanced science classes. Some teachers were open to the idea of more minority students in the advanced classes. All of the teachers who would be the teachers of the advanced science classes were open to this idea, so I saw an opportunity for success. These teachers took the lead in helping to change the criteria for entrance into the advanced science classes.

Implications for Professional Development

Because only three of the teachers in the department taught the advanced science classes, most teachers in the department were not aware of the small number of minority students in those courses. They never saw who was in those classes. Only the teachers in the department who taught those classes and I--because I was doing the research knew who were in those classes—grasped the situation. The teachers in our department decided that colleagues needed to meet regularly to get more information about policies in the schools. After much discussion, when it came time to recommend students for next year's accelerated science classes, our department agreed that diversity was an important goal to pursue. We had previously adhered to a formula based on math and science scores when choosing whom to advance to the accelerated classes. This formula proved disadvantageous to marginalized students. After discussions in our science meetings, the faculty agreed that if criteria for entrance into these classes were changed, participation by minority students would increase. With the help of the math department and the

school administration, we worked on changing the formula. In addition to changing the math formula, science teachers agreed that they should recommend minority students who had less than a 90 average for the advanced science classes, if they believed that the students would be successful there. We were successful, and the administration agreed with these changes. The required math scores were lowered; science teachers were encouraged to nominate students they thought would succeed even if their math test scores were below 90.

It took two years to change the criteria, and, although I retired from the district at the end of the second year, I kept in touch with the advanced science teachers, and they shared results with me. The expanded student group did as well as those of previous years which did not have an expanded cohort. This definitely provided some justification for the change I made. The school district was so pleased that the program has continued and expanded. Guba and Lincoln wrote about the "participatory educative nature of …research efforts." (1989, p.5). As a result of this research project, the science teachers at Suburban Junior High gained an understanding of the importance and necessity of making changes in the science program there. The changes they made have resulted in greater representation of minority students in advanced science classes at the junior high school, a greater awareness on the part of faculty as to the cultural dimensions unique to Black minority students that conflicts with mainstream education in America, and a new interest in making science teaching more culturally relevant in their classrooms. Their interest has grown as well in the part that cogens can play in understanding each others' lives. At the very least this will allow the students who benefited from these changes to expand their agency and be placed in AP science classes at the high school. This process followed Guba and Lincoln's (1989) criteria of authenticity. The research produced ontological authenticity because there was improved experience. It resulted in increased understanding, a necessity for achieving

improved experience. There was catalytic authenticity because action was taken. Tactical authenticity was also seen in the ability to act toward change. Participants were able to learn and understand the importance of making changes in the science program and were able to act.

As we kept our conversations going during the common planning time, teachers began to realize that cultural practices helped individuals interact in the world in many ways and that an individual's practices might differ depending on the fields in which he or she had participated. We agreed that all students might not have been able to utilize the structures or resources of the classroom. Teachers were also open to the idea that they might not have recognized the ways in which minority students were contributing positively to the class and, in turn, that minority students might have been turned off by their teachers due to shutdown strategies that influenced the students in negative ways. We decided that both students and teachers needed to articulate their needs in the science classroom better.

Drawing Conclusions

As in many classrooms in the United States, the students in my classroom came from a diverse range of ethnic, racial, and socioeconomic backgrounds. During my research my classroom provided a structure for increased class interactions and offered more opportunities for the inclusion of all members of the class. Students who participated in conversations acquired more energy and self-confidence. The students in my cogen group were successful in my science class. Karen and Krystal advanced to AP science classes at the local high school. The cogen students had greater interactions with their peers after cogens. They were more confident and wanted to work with their classmates. When they were at lab stations, they worked with enthusiasm. Their peers welcomed them which also expanded their agency. A community of learners formed, contributing to a positive learning environment. This in turn produced a sense of community and of success in science. The students in my cogen and in my science class

collaborated with me as we worked to create new culture through conversations. Cogens helped to create student engagement as well as synchrony and entrainment. Cogens became a tool to build community in my science class.

Cogens produced and sustained high levels of positive emotional energy. They also produced negative energy, but that energy was repaired and the cultural flow maintained. This was evident in laboratory activities and in cogens themselves. In the laboratory exercise in which Dee dropped the car, she was able to complete the lab because the negative energy was repaired and cultural flow maintained. The negative energy was in the form of feelings that Dee had when she dropped the car and thought that she had ruined it. The negative energy was repaired when she was able to fix the car and continue with the lab with the encouragement of her lab partners. In the cogen in which Beautiful worked on the Punnett square, the negative energy she felt when she thought she was unable to complete the cross changed to positive energy when she saw that she could figure out the proper way to complete the cross. Again, the negative energy was repaired, and the flow of the activity continued. I learned how sociality, which is part of the BCE, helped students find successful ways to complete their lab activities. Most of the students, Black, White, Hispanic, and Asian had been together in the same school district for many years, so the divide between mainstream culture and the cultural mismatch which I addressed had been there for most, if not all, of their school experience. I never discussed this mismatch with the students who were not in the cogen. In hindsight I realize that I should have done so, and this would be an excellent research project for the future. It is unfortunate that in our New York schools and in many schools in this nation teachers and students are slow to understand each others' cultures and overcome the cultural mismatch that exists today. I was slow myself to understand it and to address it.

Producing Fluent Interaction Chains

I found that mutual focus among students and between students and teacher contributed to fluid interaction chains and that mutual focus occurred when participants shared space, oriented their bodies to face one another, and positioned their heads so that they had eye contact. Mutual focus led to solidarity. Solidarity among the Black students in our school was often misinterpreted as collective bad behavior because of the cultural mismatch of people from racial and ethnic groups that were different. Black groups share and enact together. At department meetings I explained to the other teachers how using the process of cogens could help stakeholders understand why solidarity should be looked at from a positive perspective rather than from a deficit perspective. We discussed how it could be an empowering force in our laboratory and class activities.

I used cogens to lead discussions. I did not, however, regularly hold cogens between stakeholders. I never brought the teacher who had a confrontation with Torie (a critical stakeholder) into a cogen with her. My cogens were only between me and my students and among the students themselves. The discussion between my colleague and myself regarding Torie was not a cogen, although we did discuss a shared event and experience. The situation was established, but it was never examined. Through the neutral field of cogens, my students and I discussed power relationships as well as their roles in these power relationships. Torie, a student from the second year of my study, was unable to overcome comfortably her power conflict with the White male teacher in the room next to mine (and the problem was never resolved to her satisfaction). This was an example of a cogen failure. However, my dialogue with that teacher—which could have turned into a cogen but didn't because the conversation between the teacher and myself did not continue--did prevent her from being punished for being social.

Review of the Chapters--Learning Step by Step

Culture of Science and Its Theoretical Frameworks

Those who are marginalized can experience science classrooms as places of struggle and repeated failure. High-needs American school districts like mine need to provide the academic and social tools for low-income students to overcome obstacles that have traditionally prevented them from achieving their full, long-term, educational, professional, and democratic potentials. Teachers need to recognize and support students' practices when they bring these practices from other fields. Until I began my research, I often asked any students who were moving about the room to sit down and be quiet. I also felt that I needed to keep control to be a good teacher. I discouraged my students from calling out. I did so, consciously or unconsciously, by facial expression, gesture, or movement of my body and also with stronger, more direct interactions like raising my voice and even occasionally banging a book on the desk for attention. As Torie and other members of my cogen found out, as students pass through the halls, their day may begin with negative interaction with their teachers. In my own case I found that teachers in our school, including me, used shut-down practices in the classroom. Behaviors that they deem inappropriate in the classroom are those associated social interactions with peers, forms of argument that are loud and seem to be aggressive, and rhythmic tapping and body movement in lieu of sitting still at a desk. Although I did not see much change in the behaviors that teachers felt did not belong in the classroom, at least teachers became more open to possible reasons why their students were not doing as well as both teachers and students thought they ought to be.

An Immigrant Background—An Autobiography

Chapter 2 is autobiographical. In 1952 I came to the United States from Germany. As the child of immigrants and as an immigrant myself, I am in tune with many of the problems faced by immigrant students today and those faced by first- and second-generation students. In this

chapter I describe my journey toward a career in science education as well as the changes I witnessed as the borough in which I lived, the Bronx, underwent White flight, as neighborhoods and school populations changed. Upon graduation from college, I began my first job as a science teacher at Taft High School in the Bronx. While I was at Taft, I formed easy alliances with the Black female students. As a teacher-researcher, I drew on many of the past experiences that I had in and out of the classroom. The idea of collaboration between a teacher and a student is central to my work and to the idea of cogens. This chapter also addresses the issue of teachers' need to recognize and support students' practices that come from fields outside the classroom and the ways these practices can be utilized in the science classroom.

Constructing and Understanding Ethnic Identity

The students in my cogen were females, both native-born and the children of immigrants who are known as the second generation and/or 1.5 generation. In the first year of the study, of the two participants in the cogen one was Jamaican and the other native Black. The five students in the cogen in the second year were Haitian, Jamaican, Dominican, and native Black. Students who were not in the cogen were not involved in conversations with me. If we did have discussions, it was about the laboratory procedures we were involved in. The students in my cogen did collaborate with other students more readily than they had before, and the science class of which the cogen group was a part of generally collaborated with me to a greater extent than other science classes did, as we worked to create new culture in our classroom.

In Chapter 3 I show how I used cogens to examine immigration, race, ethnicity, and gender in my science class. I also became more aware of the interplay of race and ethnicity in my classroom. I began to use more culturally relevant teaching methods to conduct my classes. I also began to understand better Black cultural ethos and its importance in the way Black students

interact with classroom lessons, with other students in the class and with the teacher as well. The cogen helped students voice their opinions in a manner and a place that was supportive and helped them to understand similarities, differences, and contradictions in their science class as well as in other nested fields.

In Chapter 3 I also look the complex ways ethnic identity is constructed today. Children of immigrants live in a world of new and shifting ethnic divisions of which outsiders are barely aware. The 1.5 immigrants (children born in another country but raised in the United States) and the second generation share with previous waves of immigrant youth the experience of attempting to reconcile their cultural heritage with American society. These challenges, it goes without saying, are sometimes not the same as those faced by earlier immigrants. In this part of my critical ethnography, based on intensive studies of two of the students in my cogen, I identified a base of cooperation and conflict between Karen, a second-generation Jamaican, and Beautiful, a member of the wider, native Black population. Although ethnic distancing and segregation often occur in multiethnic schools, I also found friendships developed among Black, immigrant, and White students. Karen and Victoria, a White student, often worked together. They appreciated each other's science knowledge and commitment to their schoolwork. They knew each other from previous years. Beautiful and Krystal were friends and worked together. Beautiful, Torie, and Karen showed verve and commensalisms as they worked on the Punnett squares and discussed the confrontation Torie had with the teacher in the hallway. Ethnicity, class, and gender shape young people's lives.

Using Cogenerative Dialogues in my Class and Other Classes

In chapter 4 I explain the rules of the cogen and present some vignettes in which issues were raised and addressed. While doing this research, I realized that my teaching practices had

not changed much since the 1970s. My experience with my colleagues at Suburban Junior High School suggests that they are unprepared to teach minority students, just as were my colleagues at Taft in the 1970s, when I began working. This may be true in many science classes across the country. Through cogens I began to understand these shutdown strategies and how they affected my students' education. In this research cogens did provide a way for teacher and students to share their cultures and begin to understand each other, paving the way for an understanding of science. Although as far as I know (because I since have retired from the school) colleagues did not institute cogens, but we, the teachers in the science department, spoke to the administration, who saw how their goals and ours were aligned. Soon all stakeholders, my chairperson, the science department, and the administration, were on board with the idea that this research I was doing was valuable. Cogens helped students voice their opinions in a manner and a place that was a support for them and which helped them understand similarities, differences, and contradictions among themselves and between them and me in our science class as well as in other fields outside the classroom.

Chapter 5 discusses the laboratory activities we practiced as we studied for the regular, standardized 8th grade science test. We did a solubility lab. This was one way for the students to practice laboratory skills required for the hands-on performance section of the exam. During this practice, students showed evidence of sociality, verve, and movement. The incorporation of verve changed the dynamics and environment in my classroom so that students performing routine activities were now involved in various activities or even in multiple learning activities that occurred simultaneously. Dee and her partners exhibited synchrony. Successive and synchronous practices generated positive emotional energy and led to interaction chains that connected and built on one another. I observed synchrony through eye contact, head movements,

body orientation and movement, facial expressions, gestures, verbal utterances as well as the interaction with people and materials.

What I Leaned about Understanding Engagement and Learning-Producing Capital

In the first year of my study, Dee and Ebony were able to access their agency and become more confident in their science knowledge as a result of participating in cogenerative dialogues. Just meeting with me as the teacher helped them to act independently in class as well as to be involved between themselves and with the larger group in shared responsibility. I was slow to see the capital in these youth, but, when I began to understand the capital they were bringing into class, these students began to understand that they could be good science students.

Chapter 6 presents some vignettes from lab activities in my class and cogens. By studying the cogens, I tried to gain a better understanding of the nature of engagement, the interaction between science lessons and student engagement, and the relationship between engagement and learning. The students in the cogen exhibited expanded agency as they accessed resources and were able to use their own resources to complete the genetics-cross activities successfully. As I explored social life in my classroom, I also catalyzed social transformations as Beautiful, Torie, and Karen worked together.

A change frequently seen in my class was that participants in the cogens began to coteach in a variety of ways, assisting peers to learn when help was needed. In the second year of the study, during one of the cogens we were discussing a genetics lesson from the previous day. The lesson had been on how to fill in the parents' and children's genetic relationships in a Punnett square. During this lesson, Torie initiated an interaction in which there was a mechanism for mutually-focused emotion and attention. Often, students from the cogen took a leadership role in the class. When the class became too noisy it was often a student from the cogen who reminded

peers to quiet down. Karen often played that role. To a lesser degree, Beautiful also used her voice to keep the class flowing smoothly when the talk got too loud. She was often more aggressive in her expressions than Karen, but the result was similar. Students respected both Karen and Beautiful and reacted positively to them.

When cultural differences are present, cogens can be places in which participants learn to cogenerate outcomes. In the cogens carried out during my research we learned to work together to complete laboratory experiments successfully and learn about genetics and solubility. Capital is produced as participants successfully interact and transact with others from different cultural backgrounds. Beautiful became a more confident science student as she interacted with Karen, and Torie. Cogens produce social networks that included participants from diverse cultures; these participants earned and showed respect for others' cultures. Karen and Krystal, for example, learned about each other's culture. Karen also realized that her culture was different from that of Shantelle's, Torie's and Beautiful's although they were all Black. I also learned about their culture as they learned about mine. In cogens teachers gain an opportunity to work as a team with their students and to reflect upon their pedagogical practices and beliefs about teaching and learning. This was the case in the cogens that I carried out with my students.

I studied the dialectical relationship between agency and structure in my science class, and within the cogen group I found that, as students gained agency, they were more successful at entering accelerated science classes and being successful in those classes.

Identity can be produced in cogens and enacted in science class. Chapter 6 is a discussion about the ways students and teachers began to understand each others' ontologies and their importance in the teaching and learning of science. (Collins, (2004) used the sociology of emotions as a theoretical framework for understanding interactions and the extent to which they

become resources for creating a community of learners and contribute to a positive learning environment. Participating in cogens helped to transform students and teachers into more responsive and active colearners.

The Future: Improving Experiences of Marginalized Students

As other countries promote rapid advancement in science, the United States must optimize the participation of all students. The long-standing competitive edge of the United States in science, technology, engineering, and mathematics is being challenged. My study examined how using students' culture could increase science achievement in the classroom. Some of the positions of BCE--verve, movement, and sociability--were part of the culture studied. Understanding these dispositions helped me and students understand each other.

Outcomes and Implications for Further Education

Research Limitations

Once the students in my school passed advanced science classes in junior high, they were placed in advanced science classes at the local high school. After I concluded my research and after I retired, I was invited to return to school to attend a science department meeting. At that meeting I found out that the science teachers at the high school were not familiar with cogens and did not make time in science department meetings for discussions of how to align the culture of teaching and learning. Some of the marginalized students who had worked so hard in our junior high dropped out of the AP classes in the high school. In order for cogens to succeed and to further the alignment of culture in the teaching and learning of science, all stakeholders must take part. In the high school this did not occur. In our junior high school administrators, teachers, and students were on board, and success followed. The use of cogens works as a tool where students and teachers can create new practices and theory. Teachers and students can collaborate to produce success, as my research shows.

Being a teacher-researcher improved my teaching and increased positive emotional energy for me and my students. Although the transition to the high school continues to be problematic, the entire school district was proud of the results all of our students achieved on the Earth Science Regents Exam. My science chairperson and the teachers of the advanced classes at the junior high told me that the school district will work hard to sustain these results and help students to succeed. I was also shown a letter that the principal had written to the science department thanking them for increasing the number of marginalized students in the advanced science classes and for the excellent scores these students had gotten. I believe that an effort in one school can have an effect on other schools. I believe that, on the basis of my findings, teacher-researchers can affect change in their classrooms and in other schools. For our district to reach the goal of having more marginalized students in the advanced classes, all stakeholders had to be involved. There is power in numbers. This research suggests that the involvement of more teacher-researchers can have a substantial effect on the ability of the United States to meet the challenge of being competitive in the sciences and of giving all students an equal chance. Achieving parity takes time and effort, but the resulting success is well worth it.

Future Thoughts

Science classrooms need to be accepting of diversity, including different types of resources that students bring with them to the classroom. Students bring their culture into the classroom as resources, and the way that this culture is used can increase the ability of students to access science information. Symbolic violence occurs continually when school systems insist explicitly or subtly that marginalized youth leave all aspects of their embodied resources outside of school. This approach will not lead to social transformation for these youth. If students are not able to use their cultural resources, their sense of agency can be truncated. I agree with Elmesky (2005) who found that, if their agency is truncated, students will not experience opportunities to

learn how to utilize their talents, skills, values, attitudes, or dispositions in ways that are empowering. My research showed that students who were able to use their values, attitudes, and dispositions found these to be empowering and were better able to complete and understand science concepts.

Expanding Agency

Science can be a tool for achieving expanded agency, especially if all children utilize their own resources to build new avenues for making the world theirs. In my classroom I tried to make the world of science an enjoyable part of students' lives through laboratory activities using culturally relevant teaching and encouraged students to continue with their science education. I found that, if students were encouraged to exercise their agency, they more easily assumed leadership roles in the class and that this transformation led to increased academic success.

Teachers may perceive Black students as lacking the culture they need to support the learning of science. I myself did not always recognize the potential of what students can do as a foundation for learning science. This may be because there were differences between me and my students in terms of race, class, and age. As a teacher I need to earn the respect of students, to show an interest in what they do, to listen to and comment on what they say, and to assist students to be successful. Sometimes a struggle for control can be catalyzed, thereby setting up the teacher as an authority figure to be disrespected, as was the case with Torie and the teacher in the hallway. In some cases students can earn the respect of their peers by disrespecting their teachers. The struggle that results serves as an incentive for students to disrespect teachers and be uncooperative. Students who cannot enact culture from their lifeworlds as a foundation for learning science will eventually feel alienated and powerless. They will be unable to participate

as a lesson proceeds, because they will not know how to participate in the classroom. Cogens are a way to prevent this feeling of alienation and disrespect.

Although my school district has a diverse school population and ideally all students should be able to access everything our district has to offer, many more White students than minority students have taken advantage of these opportunities and utilized the available resources. The Black students have often been unaware of what they have needed on test scores to be considered for the advanced classes, and often teachers and guidance counselors did not advise them of the prerequisites. In addition, Black students had few role models in these classes.

Teachers can significantly improve their classroom learning environments through research in their own classrooms. There are many benefits for students when a teacher-researcher is in the classroom. In my case the students involved in my cogen group came to utilize their cultural capital better and to exercise their agency. In addition, because more stakeholders became involved, policy changed and more marginalized students entered advanced science classes. I hope that they will also have wider access to science courses in their future.

Educational or Scientific Importance

Students are engaged in an on-going process of making sense of their world, in interaction with their fellow students, and in engagement with their teachers as educators and researchers. Emotional energy is essential, because it helps those who are participating as researchers or observers to understand what students feel about the conversations they are having. Students involved in the interaction are more likely to enjoy their experience in the classroom and therefore to continue their interest in science. This study helps the understanding of the structure of interactions in a science class by making explicit the face-to-face encounters associated with organizing, establishing, and maintaining conversations.

Staying in Touch

Although I am no longer a teacher in the Suburban School District, I have kept in touch with many members of my department. One-hundred-twenty-one students, all enrolled in the Accelerated Earth Science Regents Course for 8th graders at our school, took the New York State Earth Science Regents exam on June 20, 2008. All of the students who took the test passed with a grade of over 65%. The students from the cogen who entered this group of students, Karen and Krystal, both did well. An exceptionally high percentage (96%) achieved Mastery (grades over 85%); five students scored between 65% and 84%. (Karen and Krystal scored between 65% and 84%.) The average grade for the students was a 93%. This in itself was very unusual, as in New York State fewer than 50% of students score above 90% on this exam. The 72 boys in our school who took this exam all scored between 85% and 100%. Of the 49 girls who took the exam, 44 scored between 85% and 100%, and five scored between 65% and 84%. Of the 22 minority students enrolled (18%), the 13 boys all scored between 85% and 100%. Seven of the nine minority girls scored between 85% and 100%, and two scored between 65% and 84%. I do not have any data on how my students did in high school. I am no longer employed by the school district, and privacy rules prohibit them from releasing such information. However, the program in the junior high school has been a great success, and there are plans to continue it in the future, despite budget constraints. The district has had to hire an extra teacher to allow all the interested and qualified students (based on the new formula) to enroll. The results have convinced the administration and the math and science departments as well as other faculty members that, when all stakeholders are involved, change can happen. Guba and Lincoln's criteria of authenticity have resulted in positive change in our school district. The marginalized students were as successful in the advanced science classes as those who were not marginalized. My school district took note of this and proudly continued the program.

Achievement in Science

Eileen Parsons (2008) says the poor achievement of African American students in science begins in the early grades. She found that in 2000, 66% of Black 4th graders, 74 % of Black 8th graders, and 78% of Black 12th graders performed below a basic level of science proficiency (National Assessment for Educational Progress [NAEP], 2000a). Black students also received the lowest-scale scores of all ethnic groups and experienced no significant changes from 1996 to 2000 (NAEP, 2000a). Scholars have examined and discussed the underachievement of Blacks in science from an array of perspectives. The perspectives Parsons lists are access (Tate, 2001), self-perception (Rascoe & Atwater, 2005), teacher expectations (Atwater, 2000), and identity (Gilbert & Yerrick, 2001). The various positions surrounding the science underachievement of Black students signify the complexity of the problem.

Parsons (2008) notes that the declarations about students' cultures in mission statements like those drafted by the National Science Teacher's Association (NSTA, 2004) and pronouncements in documents such as the *National Science Education Standards (NSES)* regarding equity (National Research Council, 1996) highlight the significance of the underachievement problem of certain minority groups but provide little guidance in how to address the problem. Parson's article investigated one approach toward addressing the science achievement dilemma. Her study examined how using BCE, a construct rooted in psychology, can increase science achievement in the classroom.

Generating Agency

The patterns that I observed during my class as well as within cogens formed the basis of change of some of the teaching and learning structures in my classroom. They also led me to propose several new ways in which other science teachers could use students' prior experiences of science to further their science interest. These approaches could also demonstrate how

emotional energy, student engagement, and the building of community in a science classroom could generate agency among students which would greatly improve students' interests and abilities to continue their science education. My study examines how using students' culture can increase science achievement in the classroom. Some of the dimensions of BCE, verve, movement and sociability, were part of the culture studied (Boykin, 1986).

My cogen group and my class all scored 3s and 4s on the Eighth Grade Intermediate Science Exam. The scoring scale on the exam goes from 1-4, with 4 being the best score, and 1 being the worst score.

Late Breaking News: More Still Needs to Be Done

In today's world children are growing up in an environment that demands more education in order to succeed. As recently as December of 2008, when the results of the Trends in International Mathematics and Science Study (TIMSS) were released, it became apparent that U.S. students' average science scores are stagnating (TIMSS, 2009). U.S. scores are still stronger than those in many other countries, but our results have been static and other countries' results have been improving. Singapore topped the list in 8^{th} grade scores with an average score of 567. Students in Taiwan, Japan, South Korea, England, Hungary, and Russia were among those earning higher marks than their U.S. counterparts. The average score in the United States was 520. U.S. citizens need to be able to understand enough science in order to be able to make informed decisions. Whether students or adults, citizens need to make decisions about energy production, conservation, global warming or homeland security, science is involved. In fact, America's global competitiveness depends on our ability to educate our students in the sciences.

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